Neurocognitive Game between Risk Factors, Sleep and Suicidal Behaviour

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ABSTRACT

Introduction: Sleep and lifestyles interact to allow the appropriate development of cerebral structures, and prevention of mood disorders. But just a hand of articles identified a precise relationship between these two above, and the probability to develop a suicidal behaviour. Objective: The aim of this study is to explore how the suicidal behaviour 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 a questionnaire incorporating McNair test, and an incorporated score to evaluate suicide tendencies. The questionnaire also included socio-demographic items and other questions to exhibit a profile of suicide tendency for each individual. Results: Our results showed that the stress levels and well-being are comparable according to gender. Specifically the results showed that lack of sleep combined with a low score to McNair test strongly affects the suicidal tendency, while score of memory and attention decreased. Conclusions: The suicidal behaviour is closely linked with sleep parameters which decreased accordingly, and the family's history of medication and suicidal behaviour.

Keywords: young adult; suicide; sleep; mood disorders; sleep disorders.

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INTRODUCTION

During the critical period, considered beginning at the childhood until thirty years old, brain is particularly influenced by social and psychological interactions between an individual and his environment. The resulting interplay strongly affects the development of the central nervous system. Obviously, the majority of mood disorders are caused by a failure in one or many of these natural processing. As a consequence of these brain disorders, suicidal behaviours appear during emotional development. A healthy lifestyle ensures a healthy brain and an excellent shield skill against central nervous system failure and cognitive disabilities.

Epidemiologic data reported that, central nervous connections are modulated by the game of stimuli-response, play continuously by both nature and human, and these modulations increase the risk to develop neurodegenerative diseases and mood diseases, and also suicidal tendencies. Young adults (between eighteen years old until thirty years old) are because of that, more expose to the risk to develop anxiety and psychiatric disorders. Until now, no final therapy exists for mood disorders, but prevention of risk factors and promotions of good lifestyle are important because, suicide and brain disorders are not easy to handle.

Physical activity and sleep are potential tools able to decrease suicidal behaviours for young adults’ population (YA), compared with midlife and elderly adults. Many other studies focused on risk factors like sociodemographic pattern of economic fluctuations, usage of drugs or family history of suicidal attempts, previous traumatic events in life; known to increase mental disorders and associated psychopathologies. But to our knowledge, just a hand of studies showed an accurate relation between combinations of non-psychological and non-environmental factors in suicidal behaviours for YA. The current research seeks to exhibit incidence on suicidal behaviours of the complex combination of the following factors: sleep parameters, mood disorders parameters and general health status of our subjects.

METHODS

Ethics committee

The current research was approved beforehand, by the ethic committee of research of the faculty of arts and science of the University of Montreal, Canada. All our subjects were volunteers and signed a consenting form.

Population's Criteria

Sociodemographic and clinical raw data of age, drugs associated with suicidal behaviours, gender, education, family history disorders, memory deficiency and cognitive complaints were collected with a self-made questionnaire named Mental Health Profile of Etindele (MHPE). This scale was used in previous published studies. Current and history of medications were classified as medications of musculoskeletal, neurological, respiratory or cardiovascular disease. Other treatments were grouped into antibiotics, anxiolytics, protein drinks, acupuncture, hypnosis, sleeping pills and anti-inflammatory. McNair scale was calculated using the short version of 15 items. Subjects aged more than 40 years old, enabled to complete experiments and speaking other languages than English and French were excluded from analysis.

Suicide and Sleep Parameters

Sleep impairments and quality were authenticated with seven items; sleep duration, use of sleeping pills, history of medication, duration of medication, beginning of sleeping disorders, sleep quality ranged from 1 (very bad) to 5 (very well) and the difficulty of falling asleep from 1 (None) to 4 (very difficult). 1545 respondents were assessed in subjective suicidal behaviour using our questionnaire. It includes two different subsections related to anxiety and depression. Both were analysed together as a single scale, this last was our suicidal behaviour’s test. The self-report for assessing suicidal behaviour included 20 items scored from 0 (never or not applicable) to 4 (very often). We determined so the suicidal tendencies over the global score ranging from 0 (no tendency) to 60 (high suicidal tendency). Scores more than or equal to 25 points were considered indicative of high suicidal behaviour, with a maximum score of 60 points.

Statistical Analysis

The distribution of suicidal measures was normal, and tested with the Kolmogorov-Smirnov’s test. To analyse McNair test answers, scores were converted to a dichotomous variable, individuals with a score fewer than 15 were scored «Presence of cognitive complaints» vs whose score is more than or equal to 15 were scored «Presence of cognitive complaints». Mann-Whitney’s non-parametric test for independent samples was used to compare McNair score as a continuous variable between two groups. Kruskal–Wallis test was used for comparing McNair score for more than two groups. Logistic regression was applied to study the relationships between McNair’s scale as a dependent variable, and sleep parameters as independent variables.

Statistical tests used an alpha of 0.05 as a level of significance. Odds ratios were calculated for sleep parameters. Data analysis was executed using SPSS Statistics-version 23 for Windows 10, 64 bits (IBM Corporation, Armonk, NY, USA). ICC values 0.70 and above were accepted as a high level of correlation. Test-retest and internal consistency analyses were performed to identify the reliability of the questionnaire MHPE. Cronbach alpha value was considered excellent for above 0.80. Intraclass Correlation Coefficient (ICC) (95% confidence interval) was used for test-retest value and Cronbach alpha was used for internal consistency measure.

Construct validity of the MHPE was assessed by factor analysis and convergent validity of the questionnaire was determined to use the Pearson correlation coefficient method
after total scores obtained from McNair scale, Hospital Anxiety and Depression Scale (HADS), and Columbia Suicide Severity Rating (C-SSRS). For the Pearson correlation coefficient, 0.87 to 1.00, 0.81 to 1.00, 0.41 to 0.60, 0.21 to 0.40, and 0.10 to 0.20 were considered to be respectively: excellent, very good, good, poor, and no correlation.

RESULTS

1545 subjects were used in the study. The response to the questionnaire was maximum. 78% of the sample was aged between 18 and 24 years, a significant proportion. One of the properties of the present research is, compared to few previous studies, a big representative population was recruited to study the impact of clinical and lifestyle factors in suicidal behaviour in adults, mainly younger adults. Women represented 64.3% of the sample. Most of the respondents were undergraduates (71%). Table 1 represented socio-demographic and clinical parameters of the total cohort. Cronbach alpha value was found 0.894, showing that this questionnaire has high internal consistency. The results of test-retest analysis was varying between 0.883 and 0.941, which shows that test-retest results are highly correlated. Pearson correlation coefficients of the MHPE Questionnaire with HADS Questionnaire was calculated 0.762 and it was found with C-SSRS is 0.774. These results showed that the MHPE Questionnaire is very well correlated with C-SSRS Questionnaire and HADS Scale.

Suicidal Behaviour and Clinical Parameters

In the analysis of family history’s disease, 41% (n=633) suffered from cardiovascular disease and 17.7% (n=273) suffered from neurologic disease. 52.4% (n=809) of them, have family members with suicidal behaviours and 35% (n=541) suffered from Alzheimer. 2.4% (n=37) of respondents were treated from cardiovascular disease, 4% (n=62) suffered from musculoskeletal disease, 6.5% (n=100) used medication for neurologic disease and 9% (n=139) has a breath impairment. All clinical parameters were associated with suicidal behaviour (p<0.0001, Kruskal Wallis test) except for the usage of drugs or memory impairment (p=0.735, U Mann Whitney's test).

The analysis of depression and anxiety showed that 89% (n=1375) of the participants have a depression but 36% (n=556) has a moderate anxiety. The average well-being score was 14±0.38 (SD) with a good correlation with McNair score (p<0.0001, spearman rank). The mean dependency score was 13.45±1.84 (SD), based on Spearman rank it’s associated with McNair score (p=0.0004). However, there was no correlation between general health score, stress score and McNair score (p=0.348, p=0.395 respectively with Spearman rank test).

Association Between Suicidal Behaviour and Sleep Parameters

Table 2 exhibits a good association between suicidal behaviour and sleep parameters except for the beginning of sleep disturbances (p=0.364, U Mann Whitney test). Table 3 showed that this association would persist even when we considered all sleep parameters as independent variables and McNair score as dependent variable. The logistic regression was employed on uncorrelated variables to identify the best indicators for suicidal behaviour score.

Multicollinearity was detected between the parameters: sleeping pills, medication, and beginning of sleep disturbances. Four variables were included: sleep duration, duration of medication, sleep quality and difficulty falling asleep. Logistic regression analysis revealed that 44.8% of the variance in suicidal behaviours was explained by sleep duration, duration of medication, sleep quality and difficulty falling asleep (Table 3).

The model was significant (p<0.05).

The variable sleep quality was the least significant factor in the model (Wald statistic= 29.06) and duration of medication the most significant (Wald statistic= 106.57). Sleep time (Wald statistic= 64.24, p-value <0.0001), duration of medication of one month or between one month and six months (p-value <0.000 vs 6 months-1 year, p=0.928), no difficulty of falling asleep (Wald statistic= 79, p-value=0.001) or have a difficulty to fall asleep (p-value <0.000 vs a little difficulty to fall asleep, p-value=0.436), mild subjective sleep satisfaction (p-value <0.000) were associated with suicidal problems. The odds ratios were ranged from 42 for the duration of medication (less than one month) to 0.058 for sleep time (5 hours).

DISCUSSION

Effect of sleep in our knowledge was not recorded continuously, and our objective is to elaborate an accurate model to predict suicidal behaviours on young adult population. Many studies were focused on environmental factors such as poverty and lake of social insurance, which could negatively increase the risk of suicidal attempts. But to our understanding, there are fewer proofs of links between simultaneous actions of the pair physical activity of participants and their duration of sleep, on the suicide in general, and suicidal behaviour in particular17-19.

It has been established in the last decade physical activity is a way to reduce stress and cognitive decline process20, while a good quality of sleep and an appropriate duration of sleep perfectly ensures brain maturation and good mental health21-27. Issue is adequate data for young adult's suicidal behaviours are not precise until now, and our findings suggest the idea of a positive interplay of lifestyle and sleep in general; on suicidal behaviour. People with less than eight hours of study and at least a moderate anxiety, has a bad global score on McNair tests and all his dimensions.

This result is also the same, in items related to suicidal behaviour. This longitudinal research confirms the hypothesis that during learning process; neuronal memory is more configured by the environment. It is may be possible that suicidal behaviours start sooner as current epidemiological and clinical literature reported. The originality is the sensitive model of prediction we are developing currently, as this research is
### Table 1. Relationships between Suicidal Behavior score and demographic and clinical characteristics

| Characteristics | Mean ±SD Or n (%) | Suicidal behavior score Mean±SD | Statistics |
|-----------------|------------------|---------------------------------|------------|
| **Demographics** |                  |                                 |            |
| **Age**         |                  |                                 | 0.01       |
| 18 - 24         | 1205 (78%)       | 17.3 ± 1.21                     |            |
| 24 - 30         | 278 (18%)        | 15.45 ± 0.39                    |            |
| 30 - 36         | 62 (4%)          |                                 |            |
| **Gender**      |                  |                                 | 0.000      |
| Male            | 552 (35.7%)      | 14.6 ± 0.209                    |            |
| Female          | 993 (64.3%)      | 14.75 ± 0.219                   |            |
| **Level of education** |              |                                 | 0.000      |
| First cycle     | 1097 (71%)       | 18.68 ± 1.23                    |            |
| Secondary cycle | 309 (20%)        | 23.60 ± 0.88                    |            |
| Third cycle     | 116 (7.5%)       | 15.30 ± 0.458                   |            |
| Else (certificat. AEC. DEP. microprogramme) | 23 (1.5%) |                     |            |
| **Medication history** |            |                                 | 0.735      |
| Cognitive or memory impairment drugs | | | |
| Yes             | 74 (4.8%)        | 13 ± 0.504                      |            |
| No              | 1471 (95.2%)     | 14.30 ± 0.191                   |            |
| Family history of neurological, musculoskeletal, respiratory or cardiovascular disease (1-6) | | | 0.000 |
| Cardiovascular disease | 588(38.1%) | 14.08±0.5 | |
| Musculoskeletal disease | 74(4.8%) | 12±0.76 | |
| Neurologic disease | 221(14.3%) | 27±1.91 | |
| Respiratory disease | 37(2.4%) | 20 | |
| Other | 221(14.3%) | 11.8±0.3 | |
| None | 405(26.2%) | 14.05±1.28 | |
| Family's history for cognitive or memory impairments (1-6) | | | 0.000 |
| Memory deficiency | 109(7.1%) | 18.33±0.491 | |
| Attention deficit disorders | 147(9.5%) | 23.75±0.221 | |
| Alzheimer | 330(21.4%) | 9±0.233 | |
| Cognitive impairments | 809(52.4%) | 14.86±0.258 | |
| Other | 0 | 0 | |
| None | 147(9.5%) | 13±0.226 | |
| Medication, current | | | 0.000 |
| Medication of neurological, musculoskeletal, respiratory or cardiovascular disease (1-6) | | | 0.000 |
| Cardiovascular disease | 37(2.4%) | 16 | |
| Musculoskeletal disease | 37(2.4%) | 21 | |
| Neurologic disease | 74(4.8%) | 19.5±1.55 | |
| Respiratory disease | 110(7.1%) | 13±0.92 | |
| Other | 110(7.1%) | 14±1.25 | |
| None | 1177(76.2%) | 14.34±0.222 | |
| Depression | | | 0.000 |
| Normal | 1375 (89%) | 14.62±0.19 | |
| Moderate | 110(7.1%) | 25±1.08 | |
| Mild | 37(2.4%) | 24±0.5 | |
| Severe | 37(2.4%) | 38±1.036 | |
| Anxiety | | | 0.000 |
| Normal | 819(53%) | 15.5±0.35 | |
| Moderate | 556(36%) | 16.86±0.76 | |
| Mild | 164(10.6%) | 15.29±0.75 | |
| Severe | 6(0.4%) | 21±1.8 | |
| General health score | 9.71±0.45 | 0.380 | |
| Well-being score | 10.88 ± 1.38 | 0.000 | |
| Stress score | 37.81±7.87 | 0.419 | |
| Dependency score | 10.64±1.04 | 0.008 | |
Table 2. Relationships between sleep parameters and suicidal behavior

| Sleep parameters        | Suicide behaviour's score Mean±SD | Kruskal ou mann whitney | p-value |
|-------------------------|-----------------------------------|-------------------------|---------|
| Sleep duration          |                                   |                         |         |
| 4h                      | 26±0.93                           | 85.11                   | 0.000   |
| 5h                      | 21.5±1.06                         |                         |         |
| 6h                      | 15.25±0.82                        |                         |         |
| 7h                      | 13.06±0.26                        |                         |         |
| 8h                      | 12.97±1.05                        |                         |         |
| More than 8h            | 15.63±0.30                        |                         |         |
| Sleeping pills          |                                   |                         |         |
| Yes                     | 28                                | 9.35                    | 0.000   |
| No                      | 13.25±0.86                        |                         |         |
| Medication              |                                   |                         |         |
| None                    | 13.54±0.23                        |                         |         |
| antibiotics             | 12±0.16                           |                         |         |
| antidepressants         | 38±0.22                           |                         |         |
| vitamins or energetic drinks | 9.92±1.5                      | 277.88                  | 0.000   |
| Acupuncture or hypnosis | 16±1.23                           |                         |         |
| Anxiolytics or sleeping pills | 26 ±0.75                   |                         |         |
| anti-inflammatory       | 11±0.88                           |                         |         |
| Duration of medication  |                                   |                         |         |
| None                    | 13.52±0.23                        |                         |         |
| Less than one month     | 17.5±0.59                         |                         |         |
| 1 month - 6 months      | 14.25±0.54                        | 139.8                   | 0.000   |
| 6 months - 1 year       | 26                                |                         |         |
| More than one year      | 13.29±0.34                        |                         |         |
| Beginning of sleep disturbances | 14.23±1.9                    |                         |         |
| None                    | 14.29±0.47                        | -0.775                  | 0.364 NS|
| Before                  |                                   |                         |         |
| Sleep quality           |                                   |                         |         |
| Very bad                | 34±1.06                           |                         |         |
| Bad                     | 18±0.91                           |                         |         |
| Mild                    | 14.75±0.29                        | 100.07                  | 0.000   |
| Well                    | 10.32±0.48                        |                         |         |
| Very well               | 5.4±0.74                          |                         |         |
| Difficulty falling a sleep |                                  |                         |         |
| None                    | 7±0.6                             |                         |         |
| little                  | 12±1                              |                         |         |
| Difficult               | 12.60±0.48                        | 211.95                  | 0.000   |
| Very difficult          | 18.87±0.11                        |                         |         |

Table 3. Logistic regression analysis of the association between subjective suicidal behavior and sleep complaints

| Sleep duration | β     | SE   | OR (95% C.I.) | p-value |
|----------------|-------|------|---------------|---------|
| 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 | β     | SE   | OR (95% C.I.) | p-value |
|------------------------|-------|------|---------------|---------|
| None                   | 0.440 | 0.212| 1.552(1.024/2.353) | 0.038   |
| Less than one 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| 1133096220.169 | 0.998   |

| Sleep quality | β     | SE   | OR (95% C.I.) | p-value |
|---------------|-------|------|---------------|---------|
| 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 | β     | SE   | OR (95% C.I.) | p-value |
|---------------------------|-------|------|---------------|---------|
| 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            |       |      |              |         |
the first step. We are able to predict the suicidal behaviour with our protocol, even with people without a medical diagnostic.

According to our observations, a regular evaluation of suicidal behaviour while controlling sleep parameters (duration and quality) and cognitive changes may lead to a sensitive model of detection.

We think, it was a weakness in the present research, not to follow changes in these parameters, and record continuously evolution of suicidal behaviours, during many weeks after the study. We also consider our population excluded people with physical limitations, like blind and autistic individuals, whose will probably improve the quality of our sample.

Each of the independent variables has been already studied alone or in association, to see their impact on suicidal aetiology, psychiatric disorders and/or neurodegenerative diseases\(^{26-30}\). But another originality of the present study, compared to previous studies above with the same design; our MHPE scale evaluated more accurately correlation between McNair test’s score and the multiple variables: age, sex, duration of sleep, suicidal behaviour, and explores more deeply simultaneous effect of depression, anxiety, global health, family suicide attempt’s history of participants.

**CONCLUSIONS**

A healthy mental function and appropriate quality of sleep including an efficient duration, contribute both to a better prevention of suicidal tendency for young adults until midlife. Young adults and midlife samples for both men and women have almost the same level of stress but, suicidal parameters of men are more affected by this combination compared to women. Age is also a main factor because the majority of our sample was aged between eighteen and thirty, and the best score for cognitive subsection and even suicidal behaviour test; was obtained by people over thirty years old. These findings suggest that, monitoring the cognitive function and sleep clinical parameters for a young adult population, may help to improve detection or at least evaluation of suicidal tendencies.

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