BRIEF COMMUNICATION

Attention Deficit Hyperactivity Disorder (ADHD) in Children, Seasonal Photoperiods, Nocturnal Movements and Diurnal Agitation

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Abstract

Objective: The main purpose of this study was to verify that the shortening photoperiods of winter contribute to increasing the nocturnal and diurnal agitation of children with ADHD and that lengthening photoperiods diminish it. **Method:** To verify this hypothesis we chose a location where daylight times drop drastically in the fall: Edmonton (Canada). The study's sample was fifteen children, varying in age from 7 to 9 years (M=8.13 years old). The participants were divided into two clinical groups and one control group. The first clinical group was made up of five (*n*=5) children diagnosed with ADHD and treated with psychostimulants. The second clinical group was made up of five (*n*=5) children with ADHD not treated with psychostimulants. The control group was composed of five (*n*=5) children showing no signs of ADHD or psychopathologies. The intensity of diurnal agitation linked to ADHD was evaluated by teachers using the French version questionnaire (SWAN-F) at T1 (first day of experiment). The children's nocturnal movements were evaluated using actimetry. Their sleep quality was measured with a sleep agenda. These last two measurements were carried out for five consecutive days when the length of the photoperiod was at its shortest (end of December). The same procedures were repeated at the end of June (T2), when the photoperiod was at its maximum. **Results:** The principal results support the study's hypothesis and show a significant baseline difference (*p*=0.008) between the nocturnal motor movements of the ADHD children and those of the control children. **Conclusions:** According to these results, this type of research should be reproduced in other Nordic countries and should include a larger sample group of children diagnosed with ADHD.

Key words*: *ADHD, seasonal photoperiods, nocturnal movements, diurnal agitation

Résumé

Objectif: L'objectif premier de cette étude consistait à vérifier si la diminution de la photopériode durant l'hiver contribue à augmenter l'agitation nocturne et diurne des enfants atteints d'un TDAH et vice versa, l'augmention de la durée de la lumière estivale diminuerait l'agitation de ces mêmes enfants. **Méthode:** Afin de vérifier cette hypothèse, nous avons choisi un lieu où la photopériode diminue drastiquement à l'automne soit, Edmonton au Canada. L'échantillon était composé de quinze enfants âgés de 7 à 9 ans (M=8.13 ans). Les participants furent divisés en deux groupes cliniques et un groupe contrôle. Le premier groupe clinique était composé de cinq (*n*=5) enfants diagnostiqués TDAH et traités aux psychostimulants. Le second groupe clinique était composé de cinq (*n*=5) enfants diagnostiqués TDAH mais non traités aux psychostimulants. Le groupe contrôle était composé de cinq (*n*=5) enfants non atteints du TDAH ou d'une autre psychopathologie. L'intensité de l'agitation diurne fut évaluée à l'aide de la version française du questionnaire (SWAN-F) par les enseignants au T1 (à la première journée de l'expérimentation). Les mouvements nocturnes des enfants furent évalués par l'entremise de l'actigraphie. Ces mesures furent prises durant cinq journées consécutives lorsque que la photopériode était à son plus bas (à la fin décembre). La même procédure a été reproduite à la fin juin (T2), lorsque la photopériode était à son plus haut. **Résultats:** Les principaux résultats appuient l'hypothèse de cette étude et suggèrent une ligne de base différente significative (p=0.008) entre les mouvements nocturnes chez les enfants TDAH et ceux du groupe contrôle. **Conclusion:** Compte tenu de ces résultats, ce type d'étude devrait être reproduite dans d'autres pays nordiques et comporter un plus grand nombre d'enfants atteints de TDAH.

Mots clés: TDAH, photopériode saisonnière, mouvements nocturnes, agitation diurne

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Introduction

Attention deficit, with or without hyperactivity disorder (ADHD), remains the most frequent reason for the referral of young children to child psychiatry (Krutscher, 2008). The scientific community agrees that ADHD is not the result of one clear and single cause and that it probably has many origins. The most frequently cited etiological hypotheses are: 1) genetic, 2) neurochemical, 3) neurobiological, 4) related to executive functions, and 5) environmental (Bélanger et al., 2008). This last group of hypotheses involves different possible causes but rarely touches on the seasons, climate, or even the geographical areas where children affected by this disorder live. Yet, it has been well established that certain environmental factors, such as temperature and exposure to daylight, play a significant role in the etiopathogeny of other mental disorders, such as seasonal affective disorder (SAD) (Haffen & Sechter, 2006). Among the aggravating factors of the ailment SAD, sleep disorders figure prominently (Cheiweiss & Gronfier, 2008). Studies also suggest that light variations may affect circadian rhythm, causing sleep disturbances in both children and adults with ADHD (Gruber et al., 2009; Ryback, McNeely, Mackenzie, Jain, & Levitan, 2006). While several studies show that children with ADHD move more during the night than children who do not suffer from this condition (Konofal, Lecendreux, Bouvard, & Mouren-Siméoni, 2001; Lecendreux, Konofal, Bouvard, Falissard, & Mouren-Siméoni, 2000), our review of the literature has not found any research investigating the potential effects of winter and summer photoperiods on sleep, and especially on nocturnal motor agitation in children suffering from ADHD. Given these findings, we propose to consider that seasonal fluctuations in the amount and timing of daylight alters circadian rhythms and that this change, in turn, affects the sleep quality of children with ADHD. Finally, latitude has an effect on the intensity of SAD in children (Sourander, Koskelaine, & Helenus, 1999), and we chose to study ADHD in Edmonton, where daytime lengths drop considerably in winter (7.5 hours of light at the lowest photoperiod) and rises drastically during the summer (17 hours at peak).

Objective and Hypothesis

The main goal of this study was to verify the hypothesis that shortening winter photoperiods are a contributing factor in increasing the nocturnal and diurnal agitation of children suffering from ADHD. The following hypothesis was formulated: A significant increase in nocturnal movements and diurnal agitation (including inattention, impulsiveness and hyperactivity) will be observed in children with ADHD during the winter photoperiod when the hours of daylight is shortest.

Method

Participants and Procedure

The children considered in this study, three girls and twelve boys, were from 7 to 9 years old (M=8.13 years old). Two thirds of them, after a rigorous examination by a mental health professional (child psychiatrist or developmental pediatrician), were diagnosed as having had ADHD for at least 12 months according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV™) criteria as well as severity criteria. The children were divided into two clinical groups and one control group. The first clinical group was composed of five (n=5) children diagnosed with ADHD who were being treated with psychostimulants (TP). The second clinical group consisted of five (n=5) children diagnosed with ADHD. These children were not being treated with psychostimulants (NTP). Finally, the control group was composed of five (n=5) students showing no signs of ADHD or any other psychopathologies. Based on their school records, the intelligence of all participants was within the normal range. Also, all participants were in a healthy weight range and did not show any sign of obstructive sleep apnea according to their medical records. Table 1 displays some of the characteristics described above.

The study's experimental structure was based on two measuring times. During the first study period in December (T1), ADHD-linked diurnal agitation intensity was evaluated by homeroom teachers with the help of the Symptoms and Normal Behavior questionnaire (SWAN-F) (Robaey, Amre, Schachar, & Simard, 2007). The same homeroom teachers repeated the same evaluation in the study's second assessment period in June (T2). Nocturnal movements were evaluated using actimetry. The subjects were instructed to activate the signal button on an actigraph when going to bed. Their sleep quality was also gauged by means of a sleep agenda. These two measures were made on five consecutive weekdays of the period when photoperiod length was at its shortest (T1), at the end of December, 2008, and again at the end of June, 2009, when photoperiod length was at its longest (T2).

Measures

Sleep Quality

The subjects' sleep quality was measured using a sleep agenda available on the Internet called "The Morpheus Network Wake and Sleep Calendar." The children were required to fill out this sleep agenda each morning with the help of a parent. The tool includes three scales for 1) sleep quality, 2) waking quality, measured by how they felt when they woke up (tired, energetic, etc.), and 3) daytime quality, that is, their general well-being during the day (tired, energetic, etc.). Each one of the scales presents the following five quantifiable evaluations: 1) Very Poor (= -2), 2) Poor (= -1), 3) Average (= 0), 4) Good (= 1), and Very Good (=

Table 1. Characteristics of children

Child	Age in years	Gender	Race	Height in feet	Weight in pounds	Body Mass Index	ADHD subtypes and severity	Other diagnoses	Medication
1	9	Boy	Caucasian	5.3	88	15.6	ADHD-MCT	ODD	MR-MPH
2	8	Girl	Caucasian	4.3	60	16.3	ADHD-MCT		IR-MPH
3	9	Boy	Caucasian	4.5	61	15.3	ADHD-MCT		IR-MPH
4	8	Boy	Caucasian	4.6	60	14.5	ADHD-SIT		MR-MPH
5	8	Boy	Caucasian	4.0	47	14.4	ADHD-MCT	ODD	IR-MPH
6	7	Girl	Caucasian	3.7	45	16.8	ADHD-M1T		
7	9	Boy	Caucasian	5.2	84	15.4	ADHD-MCT		
8	8	Boy	Caucasian	4.9	80	17.3	ADHD-MCT		
9	7	Boy	African Canadian	4.1	50	14.7	ADHD-MCT	SAD	
10	7	Boy	Caucasian	4.3	55	14.9	ADHD-MCT		
11	7	Boy	Caucasian	3.9	46	16.0			
12	8	Boy	African Canadian	4.4	65	16.9			
13	9	Boy	Caucasian	5.0	80	15.7			
14	9	Boy	Caucasian	4.4	65	16.9			
15	9	Boy	Caucasian	4.6	68	16.4			

Note. ADHD-MCT is Attention Deficit Hyperactivity Disorder Moderate Combined Type; ADHD-SIT is Attention Deficit Hyperactivity Disorder Severe Inattentive Type; ADHD-MIT, Attention Deficit Hyperactivity Disorder Moderate Inattentive Type, ODD; Oppositional Defiant Disorder; SAD, Separation Anxiety Disorder; IR-MPH, immediate-release methylphenidate; MR-MPH, modified-release methylphenidate.

2). In light of the objectives of this study, we compiled only the data generated by the sleep quality scale.

Diurnal Agitation (Inattention, Impulsivity and Hyperactivity)

The intensity of day-time inattention, impulsivity, and hyperactivity, three behaviors linked to ADHD, was measured using the Strengths and Weaknesses of ADHD Symptoms and Normal Behavior questionnaire (SWAN-F) (Robaey et al., 2007), which contains 18 items for measuring ADHD. Based on the previous Swanson (1992) (SNAP) rating scale, items were reworded from the categorical approach of the Australian Twin Behavior Rating Scale (ATBRS) (This child: “Has trouble following through on instructions and doesn’t finish schoolwork, chores or duties?”) to a dimensional approach (Does this child: “Follow through on instructions and finish school work or chores?”). On the SWAN scale, teachers rated items on a seven-point scale, from -3 = far above average, to 0 = average, to 3 = far below average. An individual’s total score on the inattention and hyperactivity-impulsivity dimensions of the SWAN scale were then averaged to range from -3 to 3, with a high score indicating a higher level of ADHD symptoms or problem behavior.

Nocturnal Movements

Nocturnal motor movements were evaluated with the help of an actigraph, a small apparatus, similar to a wristwatch, which is worn day and night (except in the bath or shower) on the subject’s non-dominant wrist for five consecutive days and nights during the school week. The device is useful for identifying sleeping and waking schedules, as well as the nocturnal and diurnal motor activation periods that are important for evaluating ADHD (Ancoli-Israel et al., 2003). The actigraph used in this study was the MiniMitter AW-64 and its data was analyzed with the software Actiware 5.0. Given this study’s hypothesis, two variables were computed using the actigraphic data: the total sleep duration and the number of nocturnal movements.

The Photoperiod

The photoperiod is defined as the relative length of the daytime period over 24 hours. It is perceived by the retina and its duration is integrated daily by the suprachiasmatic clock (Challet, 2009). In the present study, the photoperiod was measured using the data available on Environment Canada’s website in December, 2008 and June, 2009.

Data Analyses

To determine whether there was a significant difference in the subjects’ nocturnal movements and diurnal agitation (inattention, impulsivity/hyperactivity) between T1 (December) and T2 (June), non-parametric analyses (Kruskal-Wallis) were used. As previously mentioned, because of the small size of the sample, the analyses were compared with a *P*-value of $p = 0.01$ set as the limit for statistical significance.

Table 2. Averages (A), standard deviations (SD), differences (D) and differences in percentage (DP) between T1 and T2 results for the three groups of children, and differences between T1 and T2 results for ADHD children being treated with psychostimulants (TP) compared to ADHD not treated with psychostimulants (NTP)

	ADHD children treated with psychostimulants (n=5)				ADHD children not treated with psychostimulants (n=5)			
	T1	T2	Difference	% Difference	T1	T2	Difference	% Difference
Variables	A (SD) P	A (SD) P	A (SD) P	A	A (SD) P	A (SD) P	A (SD) P	A
Number of hours of sleep	8.36 (0.38)	7.90 (0.65)	0.46 (0.76)	5.50%	9.44 (0.28)	8.55 (0.40)	0.86 (0.32)	9.1%
Number of nocturnal movements	173.88 (18.5 60) 0.222	134.24 (11.525) 1.000	39.64 (9.396) *0.008	27.79%	227.88 (68.985) *0.008	162.08 (32.300) 0.548	115.80 (65.187) *0.008	50.80%
Inattention	11.60 (5.595) *0.008	7.00 (3.391) *0.008	4.60 (2.608) 0.016	39.65%	17.80 (3.271) *0.008	11.60 (4.393) *0.008	6.20 (2.168) *0.008	34.83%
Hyperactivity/ impulisivity	11.00 (4.183) *0.008	7.20 (2.168) *0.008	3.80 (2.775) 0.056	34.54%	18.80 (2.387) *0.008	11.20 (1.304) *0.008	7.60 (1.817) *0.008	40.42%
Sleep quality	-0.48 (0.335)	0.32 (0.576)	-0.8 (0.678)	166%	-0.6 (0.678)	0.52 (0.228)	-1.12 (0.392)	186%

Note. *significant at α = 0.01

Results

Table 2 displays the results relative to averages, standard deviations, differences, and the differences in percentage between the three groups. The striking results shown in this table merit a passing comment, though they have no bearing on the confirmation of our research hypothesis. They indicate a significant improvement in sleep quality at T2 in both ADHD-TP children (166%) and ADHD-NTP children (186%) compared to control-group children (28.16%). This could be explained by a significant drop in nocturnal motor movements of ADHD children in June: less motor activity during the night would cut down on the number of micro-awakenings and improve the children's sleep quality. This explanation seems plausible, but it has yet to be verified in a context that considers the photoperiod variation from one season to the next. The results in Table 2 also indicate a significant difference ($p = 0.008$) between ADHD-TP and ADHD-NTP children relative to nocturnal motor movements, according to the data gathered both in December and June. That is, the difference between the ADHD-TP children's' level of nocturnal movement during the five nights in December and the five nights in June was greater than in the ADHD-NTP children. However, the results do not indicate any significant difference in diurnal motor agitation between the ADHD-TP and ADHD-NTP children when December and June data are compared.

Table 3 results show a significant baseline difference ($p = 0.008$) between the nocturnal motor movements of the children suffering from ADHD-TP and those of the control-group children. The difference between the ADHD-TP children's' levels of nocturnal movement in December and in June was greater than that of the control children. However, the results do not show a significant difference between the two groups in the other variables (inattention, impulsivity/hyperactivity), meaning these results only partially support our research hypothesis.

Lastly, the results shown in Table 4 suggest a significant difference ($p = 0.008$) between the nocturnal motor movements of the children with ADHD-NTP and the control children. They also indicate a significant difference ($p = 0.008$) between the two groups in terms of diurnal agitation (inattention, impulsivity/hyperactivity). In other words, the difference between the levels of nocturnal and diurnal agitation in the children with ADHD-NTP between December and June was greater than the difference in the control group. This finding would seem to confirm our research hypothesis.

Discussion

We formulated the hypothesis that a drastic shortening of the photoperiod in winter would contribute to increasing both nocturnal and diurnal motor agitation in a group of children with ADHD. We can say that this hypothesis has been partially confirmed. Indeed, T1 (December) and T2 (June) comparisons between children in the ADHD-TP group and the control group indicate a significant difference in nocturnal agitation. Yet the ADHD-TP children did not experience more diurnal motor agitation than the control children. Were the psychostimulants a factor in preventing the deleterious

Control children (n=5)				Differences between T1 and T2 results for ADHD children TP compared to NTP		
T1	T2	Difference	% Difference	T1	T2	Difference
A (SD) P	A (SD) P	A (SD) P	A	P	P	P
9.58 (0.55)	8.78 (0.55)	0.80 (0.72)	8.35%			
146.24 (41.742)	142.68 (39.019)	3.56 (7.649)	2.43%	*0.008	0.151	*0.008
11.20 (5.167)	10.80 (3.421)	0.40 (2.074)	3.57%	0.056	0.095	0.421
11.20 (4.868)	12.20 (5.495)	1.00 (1.225)	8.92%	0.032	0.016	0.056
0.71 (0.392)	-0.84 (0.297)	-0.2 (0.346)	28.16%			

effects of a restless night on ADHD children's diurnal symptoms? This question could be more closely examined in future studies. Another interesting finding was that the above-mentioned difference was not observed between ADHD-NTP and control children, suggesting that, as postulated at the beginning of this study, hyperactive children not treated with psychostimulants are more agitated both night and day than control children. Although the results would tend to confirm our research hypothesis, they remain incomplete due to contributing factors not controlled for in our study. For example, it would be helpful to consider the effect of the lighting in hyperactive students' classrooms, since the effects of light on mental well-being would seem to depend not only on length of exposure but also on intensity. It would also be appropriate to examine such variables as weather, humidity, temperature, and the amount of time hyperactive students spend outdoors in winter. On this point, the study conducted by Einarsdottir (2008) shows the important role played by certain environmental factors in the etiology of the disorder. The teachers who participated in Einarsdottir's study were of the opinion that changes in the lifestyle of young Icelanders in the last 10 years had contributed to the increase in ADHD diagnoses. The current requirements of the Icelandic education system do not encourage young children to play outside, thus depriving them of the benefits of daylight. This phenomenon is not unique to Iceland and ought to be considered in future research as it pertains to other Nordic countries like Canada. On this point, it would be interesting to know whether young Canadians of Icelandic descent who suffer from ADHD are less susceptible to the effects of light deprivation during the winter than children of other national origins. Studies of this nature would complement a study by Axelsson and colleagues (Axelsson, Stefánsson, Magnússon, Sigvaldason, & Karlsson, 2002) on the etiology of seasonal affective disorders (SAD) in Canadians of Icelandic and non-Icelandic descent. As well, we maintain that measurements should be made of the nocturnal and diurnal movements of children with ADHD during all four seasons in order to discover any fluctuation in relation to the length of the photoperiod.

Additionally, our data indicates a significant difference in nocturnal movement between ADHD-TP and ADHD-NTP children, in that the former move less at night than the latter. In our opinion, this difference could be due to the fact that three of the five ADHD-TP children were receiving a late-afternoon dose of IR-MPH. On this point, the work of Kent and colleagues (Kent, Blader, Koplewicz, Abikoff, & Foley, 1995) has shown that a late-afternoon dose of IR-MPH had a beneficial effect on the sleep quality of a group of ADHD children.

Some limitations of the present study should be identified. For example, given that the hypothesis only involves the nocturnal and diurnal agitation of children with ADHD, we chose not to analyze all of the data computed by Actiware. It would be important in a subsequent study to analyze factors such as wakening time and sleep onset latency as they are often a source of problems in ADHD children on psychostimulants (Sangal et al., 2006). Another limit of this study has to do with the time of year in which it took place. This period coincided with the week before Christmas holidays, a factor that could potentially contaminate our results, since the Christmas season can affect the excitement level of all children, and particularly of children with ADHD (Raymond & Duclos, 2004). However, in order to reduce this bias, we did the second measure (T2) during another exciting period of the year, the week before summer holidays. It should also be mentioned that the teachers filling out the SWAN-F questionnaire were not blinded as to the treatment groups. The knowledge that a child was being treated could influence the score on this questionnaire, as it reflects the perception of the child by his or her teacher. Lastly, it must be stressed that, given the small size of the present study, the results should be considered preliminary pending replication in larger samples. In conclusion, the present study, despite its limitations, has enabled us to observe differences and raise questions concerning the probable link between

Table 3. Differences between T1 and T2 results for children with ADHD being treated with psychostimulants (TP) compared with control children			
Variables	T1 (December)	T2 (June)	D Differences
Nocturnal motor movements	0.222	1.000	*0.008
Inattention	*0.008	*0.008	0.016
Impulsivity/hyperactivity	*0.008	*0.008	0.056

Note: *significant at α = 0.01

Table 4. Differences between T1 and T2 results for children with ADHD not being treated with psychostimulants (NTP) compared with control children			
Variables	T1 (December)	T2 (June)	D Differences
Nocturnal motor movements	*0.008	0.548	*0.008
Inattention	*0.008	*0.008	*0.008
Impulsivity/hyperactivity	*0.008	*0.008	*0.008

Note: *significant at α = 0.01

less daylight and the aggravation of ADHD in a group of Canadian children, thereby pointing the way to more research in this important area of study.

Acknowledgments /Conflict of Interest

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References

Ancoli-Israel, S., Cole, R., Alessi, C., Chambers, M., Moocroft, W., & Pollack, C. P. (2003). The Role of Actigraphy in the Study of Sleep and Circadian Rhythms. *Sleep*, *26*, 342-492.

Axelsson, J., Stefánsson, J. G., Magnússon, A., Sigvaldason, H., & Karlsson, M. M. (2002). Seasonal Affective Disorders: Relevance of Icelandic and Icelandic-Canadian Evidence to Etiologic Hypotheses. *Canadian Journal of Psychiatry, 47,* 153-158.

Bélanger, S., Vanessa, M., Béliveau, M. C., Jamoulle, O., Lippé, S., Pâquet, H., Pelletier, G., & Vanesse, C. M. (2008). *Le trouble de déficit de l'attention avec ou sans hyperactivité.* Montréal: CHU Sainte-Justine.

Challet, E. (2009). Horloge circadiennes, troubles métaboliques et chronobésité. *Obésité, 4*, 73-85.

Cheiweiss, L., & Gronfier, C. (2008). *En finir avec le blues de l'hiver et les troubles du rythme veille-sommeil*. Paris: Marabout.

Diagnostic and Statistical Manual of Mental Disorders: DSM-IVTR. (2000).Washington: American Psychiatric Association.

Einarsdottir, J. (2008). Teaching Children with ADHD: Icelandic Early Childhood Teachers' Perspectives. *Early Child Development and Care, 178*, 375-397.

Environment Canada, Weather office (Sunrise/Sunset). Retrieved December15, 16, 17, 18, 19, 2008 & June 15, 16, 17, 18, 19 (2009). http://weatheroffice.gc.ca/city/pages/ab-50_metric_e.html.

Gruber, R., Xi, T., Frenette, S., Robert, M., Vannasinh, P., & Carrier, J. (2009). Sleep Disturbances in Prepubertual Children with Attention Deficit Hyperactivity Disorder: A Home Polysomnography Study. *Sleep, 32,* 343-350.

Haffen, E., & Sechter, D. (2006). *Les dépressions saisonnières*. Paris: John Libbey.

Kent, J. D., Blader, J. C., Koplewicz, H. S., Abikoff, H., & Foley, C. A. (1995). Effects of Late Afternoon Methylphenidate Administration on Behavior and Sleep in Attention-Deficit Hyperactivity Disorder. *Petriatrics*, *96*, 320-325.

Konofal, M., Lecendreux, M., Bouvard, M. P., & Mouren-Siméoni M. C. (2001) High Levels of Nocturnal Activity in Children with Attention-Deficit Hyperactivity Disorder: A Video Analysis. *Psychiatry and Clinical Neurosciences, 55*, 97-103.

Krutscher, M. L. (2008). *ADHD: Living Without Brakes*. London: Jessica Kingsley.

Lecendreux, M., Konofal, E., Bouvard, M., Falissard, B., & Mouren-Siméoni, M. C. (2000). Sleep and Alertness in Children with ADHD. *Journal of Child Psychology and Psychiatry 41*, 803-812.

Raymond, F., & Duclos, G. (2004). *Le déficit de l'attention et hyperactivité en 32 questions*. Montréal: Éditions enfants Québec.

Réseau Morphée: Agenda de sommeil. Retrieved May 10 (2008). http://www.reseau morphee.fr/.

Robaey, P., Amre, D., Schachar, R., & Simard, L. (2007). French Version of the Strengths and Weaknesses of ADHD Symptoms and Normal Behaviors (SWAN-F) Questionnaire. *Journal of the Canadian Academy of Child and Adolescence Psychiatry, 16*, 80-89.

Ryback, Y. E., McNeely, H. E., Mackenzie, B. A., Jain, V. R., & Levitan, R. D. (2006). An Open Trial of Light Therapy in Adult Attention-Deficit/Hyperactivity Disorder. *Journal of Clinical Psychiatry, 67*, 1527-1535.

Sangal, R. B., Owens, J., Allen, A. J., Sutton, V., Schuh, K., & Kelsey, D. (2006). Effects of Atomoxine and Methylphenidate on Sleep in Children with ADHD. *Sleep, 29*, 1573-1585.

Sourander, A., Koskelaine, M., & Helenus, H. (1999). Mood, Latitude, and Seasonality among Adolescents. *Journal of the American Academy of Child and Adolescence Psychiatry, 38*, 1271-1276.

Swanson, J. M. (1992). *School-based Assessments and Interventions for ADD Students*. California: KC Publications.