ORIGINAL ARTICLE

Validity Of The Morningness-Eveningness Questionnaire For Adolescents (MEQ-A)

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The present work aimed to validate the Italian version of the Morningness–Eveningness Questionnaire for Adolescents (MEQ-A) using circadian motor activity as external criterion. A sample of 60 healthy high school students (32 boys and 28 girls) wore an actigraph (Actiwatch®) on the non-dominant wrist for seven consecutive nights and days. After the recording session, all the subjects were administered the Italian version of the MEQ-A. Results showed a significantly different circadian pattern of motor activity between morning and evening types as expected. It has been underlined that such differences were found only during week-end, when the school schedule was stop and students were free to behave according to their own rhythms. On the whole the results show that the MEQ-A has good external validity. **(Sleep and Hypnosis 2007;9(2):47-51)**

Key words: adolescence, actigraph, circadian typology, morningness–eveningness questionnaire, motor activity

INTRODUCTION

One of the most marked individual differences in circadian rhythm is circadian typology (morning-, intermediate-, and evening-type) (1). Morning types are characterized by earlier bedtime and rising time and better morning performance; evening types have later bedtime and rising time and have more irregular sleep-wake habits. Adolescence is characterized by a shift from morningness toward eveningness dimension (2-5). Adolescent sleep-wake cycle is affected by pubertal development (2,4) and increased demand of school activities (6). This shift from morningness to eveningness dimension during adolescence started significantly since 12 years in different cultures (2,3,4,7), confirming pubertal factors in this change. Moreover Laberge, Petit, Simard, Vitaro, Tremblay and Montplaisir (4) pointed out that females started to show this shift before males. An advanced beginning of pubertal development in females could explain this result. Randler and Frech (8) showed that circadian typology has a relevant influence on school performance suggesting that morning types performed better in school achievement than evening types. Thus considering the relevant influence of circadian typology, it could be very useful to determine morningness-eveningness preference in adolescents. To do that, tools have to be evaluated.

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Accepted July 15, 2007

Several self-evaluation instruments have been developed to identify circadian typology. The Morningness-Eveningness Questionnaire (MEQ) has been the first tool developed to determine circadian typology in adults (9) and afterward has been adapted for using with adolescents (3). Also the reduced version of the Morningness-Eveningness Questionnaire has been proposed to determine circadian typology both in adults (rMEQ) (10) and adolescents (rMEQ-A) (11). Two others self-administered questionnaires proposed to determine circadian typology in adults, the Composite Scale for Morningness (CS) (12) and the Diurnal Type Scale (DTS) (13), have been adapted for using with children and adolescents too, the CS-CA (2) and the DTS-CA (14,15) respectively. Despite the large amount of circadian questionnaires, the most used in chronopsychological research is the MEQ. The Italian version of MEQ for adolescents (MEQ-A) was validated by Natale and Bruni (16) and successively by Tonetti, Fabbri, Martoni and Natale (11). Natale and Bruni (16) showed that the Italian version of MEQ-A determined better psychometric proprieties than the Italian version of CS-CA. Tonetti, Fabbri, Martoni and Natale (11) compared three self-administered questionnaires to evaluate circadian typology in adolescence: MEQ-A, rMEQ-A and DTS-CA. The authors confirmed the better psychometric proprieties of MEQ-A than the other two questionnaires. Andrade, Benedito-Silva and Menna-Barreto (17) validated the Portuguese version of MEQ-A using temperature rhythm as external criterion (biological index). The authors found a significant negative correlation between temperature acrophase and MEQ-A scores. This negative correlation indicates that the higher the score (more morning type), the earlier the acrophase occurs. The MEQ is a 19-item mixed-format scale in which the subject is asked to indicate his/her own life rhythms and habits as far as going to sleep and waking up are concerned, and to supply further useful information to find the most suitable rhythm. The difference between adults and adolescents versions of MEQ is formulation of items, which in adolescents version are specifically referred to the scholastic activities in which are involved. The goal of the present study aimed to confirm the validity of the MEQ-A using, for the first time, motor activity as an external criterion. The choice to use an actigraph as the instrument for data collection was done taking into account that the motor activity is a behavioural index and the actigraph consents to observe subjects in ecologic conditions.

METHOD

112 healthy high school students (64 boys and 48 girls; age range 15-19), took part as volunteers to the study. 52 subjects were discarded because they have not fully filled out the MEQ-A (or the sleep-wake diary), because they have not continuously wore the actigraph or because technical problems occurred in actigraphic recordings. The final sample consisted of 60 subjects (32 boys and 28 girls). Subjects ranged in age between 15 and 19 years (mean= 16.51 ± 1.26). This age range was selected because the onset of adolescence varies, normally occurring between 8 and 13 years in girls and 9 and 14 years in boys (18) and because investigating circadian typology, an abrupt change in the timing of sleep at around the age of 20 has been observed (19) and this change is considered the first biological marker of the end of adolescence. Actigraphic recordings were obtained using Actiwatch® actigraphs (Cambridge Neurotechnology Ltd.). Actigraphs were initialised with a 1-minute epoch. Participants wore the actigraph on the non dominant wrist for seven consecutive days, from Tuesday to Tuesday. Subjects were free to spend their day-time and sleep-time outside of the laboratory and perform

their usual activities. They were instructed to use the actigraph event marker button to signal when they went to the bed and when they woke up in the morning and fill a sleep-wake diary each day within 30 minutes after morning awakening. Data were analysed by the Actiwatch Activity & Sleep Analysis 5® version 5.32 software (Cambridge Neurotechnology Ltd.) to measure motor activity during the weekend (Saturday and Sunday). The actigraphic recording was divided into 60 minutes intervals starting from 16:00 hours of Saturday to 15:59 hours of Sunday. The hourly mean activity levels in the 24-h period were calculated for each subject. The adolescents surveyed attended the same public school in the morning from 8:00 hours to 13:00 hours from Monday to Saturday. Motor activity was analysed only during the weekend (Saturday and Sunday) because the school schedule was stop and students were free to behave according to their own rhythms.

At the end of the actigraphic recording session, participants filled the Italian version of the MEQ-A. The questionnaire was administered at the end of the experiment in order to avoid a possible bias by the subjects in their daily activity.

RESULTS

According to MEQ-A scores, and using Italian cut-off criteria (16-41 evening-type; 42-58 intermediate-type; 59-86 morning-type) (11,16), subjects were divided into three groups: morning-types (n= 11, 7 boys and 4 girls), intermediate-types (n= 43, 22 boys and 21 girls) and evening-types (n= 6, 3 boys and 3 girls). The frequency distribution of circadian typology between boys and girls was not significantly different (χ^2_2= 0.58, p= 0.74). The MEQ-A score range was 37 - 67 (mean= 51.50 ± 7.54). The distribution of the total score was normal (d= .07, p > 0.05) (skewness= .27; kurtosis= -.50) at Kolmogorov-Smirnov test.

An ANOVA was performed to examine the effects of circadian typology (three levels: morning-, intermediate-, evening-type) and time of day (24 levels) on motor activity.

Regardless to the mean motor activity over the 24-h period, no significant differences were found among circadian types (evening types= 326.58 ± 145.35; intermediate types= 274.56±162.57; morning types= 300.10± 197.69). As expected, time of day had a significant effect ($F_{23,1311}$= 26.49, p< 0.0001). Interaction between the two factors was also

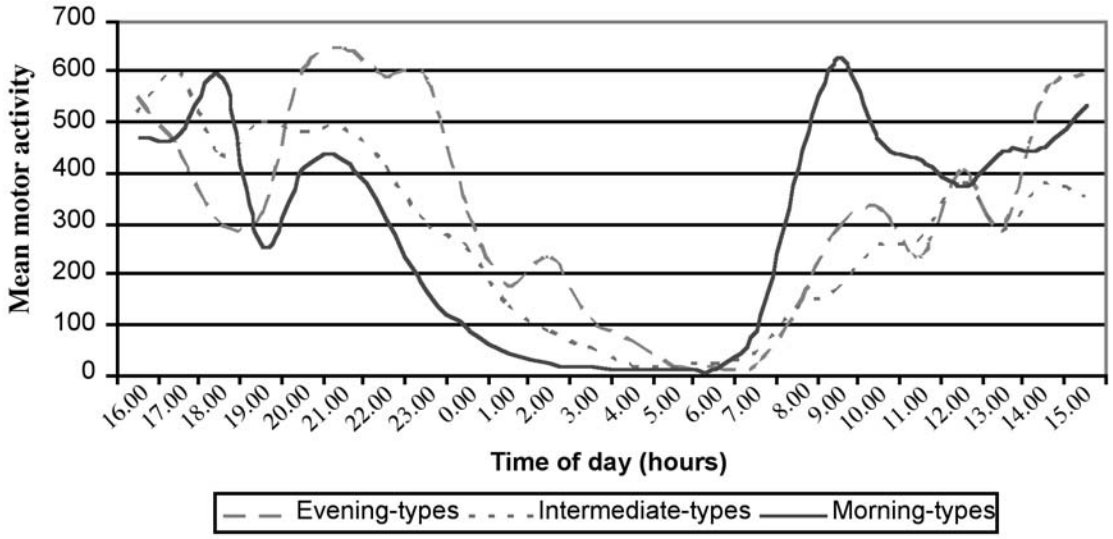

Figure 1. Hourly mean activity level (i.e. mean number of movements in 1-min epoch in one recording hour) of morning, intermediate and evening types over the 24-h period

significant ($F_{46,1311}$= 3.94, p< 0.00001). To evaluate when circadian types differed significantly, a set of ANOVAs hour by hour was performed over the 24-h period. The mean activity of evening types was higher than that of both intermediate and morning types at 23:00 hours of Saturday ($F_{2,57}$= 9.86, p< 0.0005), 02:00 hours of Sunday ($F_{2,57}$= 3.18, p< 0.05), 04:00 hours of Sunday ($F_{2,57}$= 5.32, p< 0.005) while the mean activity level of morning types was higher than that of both intermediate and evening types at 07:00 hours of Sunday ($F_{2,57}$= 3.68, p< 0.05), 08:00 hours of Sunday ($F_{2,57}$= 8.22, p< 0.0005), 09:00 hours of Sunday ($F_{2,57}$= 17.04, p< 0.00001), 10:00 hours of Sunday ($F_{2,57}$= 3.36, p< 0.05), 11:00 hours of Sunday ($F_{2,57}$= 4.89, p< 0.0001) (see Figure 1).

DISCUSSION

The results obtained on the external validation of the MEQ-A are satisfactory. Any possible bias on the role of the subjects can be reasonably excluded since participants were not aware of the aim of the study and also they filled the tool at the end of the actigraphic recording.

These results are meaningful because the subjects were monitored under extremely ecologic conditions (i.e. at home, free to behave according to their own rhythms though also partially entrained by school and social rhythms).

The features of evening-, intermediate- and morning-types were confirmed emphasizing the highest motor activity of evening types late at night and the highest motor activity of morning types at the first hours of the morning. Thus it was indirectly confirmed that morning types are characterized by earlier bedtime and rising time and that evening types have later bedtime and rising time in adolescents' population too.

It should be underlined that differences between motor activity of morning and evening types became significant only on Saturday and Sunday, i.e. when school schedule is stop. It probably means that the sleep-wake cycle of adolescents does not completely fit to conventional school schedule, discrepancy described as social jetlag (20). Transition to an earlier school start time, along with adolescents' sleep phase delay, could affect teenagers' sleep quality and daytime behaviour (21) and this occurrence can be also described as school jetlag.

The good psychometric proprieties of the MEQ-A are confirmed (normal distribution of the total score) (11,16). Considering the data of the present study, the discriminating power of the MEQ-A is confirmed even when motor activity is used as an external criterion. It can therefore be concluded that the MEQ-A can be successfully used to identify circadian typology in both experimental and applied research.

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