# CIRCADIAN TYPOLOGY AND EMOTIONAL INTELLIGENCE IN HEALTHY ADULTS

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**ABSTRACT**

Several aspects related to health like satisfaction with life, perceived well-being, and psychopathological symptomatology have been associated to the circadian typology as well as the emotional intelligence. Nevertheless, the relationships between circadian typology and emotional intelligence have not been explored yet. The purpose of the present study is to examine the relationships between circadian typology and emotional intelligence taking into account the possible sex and physical exercise interactions, and controlling for age. A sample of 1011 participants (649 women), aged between 18 and 50 yrs (26.92 ± 6.53) completed the reduced Morningness-Eveningness Questionnaire (rMEQ) and the Trait Meta-Mood Scale-24 (TMMS-24). The TMMS-24 considers three emotional intelligence dimensions: emotional attention, emotional clarity and emotional repair. Women showed higher values for emotional attention, while men showed higher values for emotional repair ($p < .035$, in both cases). Subjects who physically exercise weekly showed higher values for emotional repair ($p = .001$) regardless of circadian typology or sex. Circadian typology presents differences in all scores of emotional intelligence dimensions. Morning-type had lower emotional attention than evening and neither-type; neither-type had lower emotional repair than morning-type, and lower emotional clarity than both evening and morning-type ($p < .046$, in all cases). Moreover, circadian typology modulated the sex differences in emotional attention, only morning-type men showing lower emotional attention score. From the results of emotional intelligence it is concluded that morning typology exhibits a protective factor in terms of general health, while it should be emphasized a possible vulnerability of the neither-type for developing psychological problems.

Keywords: Morningness-eveningness; Circadian typology; Emotional intelligence; Sex; TMMS-24; Trait meta-mood.

## INTRODUCTION

The interest for studying individual differences in circadian rhythms has been increased during the past two decades. Morningness-eveningness dimension, which seems to follow a normal distribution, allows classifying individuals into three circadian typologies: Morning-, neither- and evening-type. Morning-type tends to wake up and go to bed earlier, and shows a phase advance of their biological circadian and behavioral functions as compared to evening-type. Neither-type, a population that has been scarcely studied, tends to maintain in an intermediate position. The phase differences between extreme groups may vary from 2 to 12 h depending on the studied parameter (Adan et al., 2010, 2012; Tsaousis, 2010). These differences are associated with individual differences in endogenous circadian system functioning (Levi & Schibler, 2007), which is more oriented to light/dark cycle in morning-type.

Previous works have found sex and age differences in circadian typology. Men have a more pronounced tendency to eveningness than women (Adan & Natale, 2002; Tonetti et al., 2008). On the other hand, since puberty and over the years the tendency to morningness is increased (Adan et al., 2012). Circadian typology also exhibits differences in physical activity (Urban et al., 2011) and coping strategies (Ottoni et al., 2012), being morning-type more physically active and having more coping capacity as compared with evening-type.

In psychopathological area there are several studies considering evening-type as a risk factor for developing disorders like depression, bipolar disorder, schizophrenia, eating disorders, attention-deficit/hyperactivity disorder, sleep disorders, and anxiety problems, while morning-type appears to be a protective factor in mental health. Neither-type typology has received scarce attention in this field. For this reason, the

possible associations of this typology in the development of psychopathologies remain unknown (Adan et al., 2012).

The emotional intelligence (EI) was proposed by Salovey & Mayer in 1990 as a set of abilities to process emotional information accurately and efficiently, including the ability to perceive, assimilate, understand, and manage emotions in himself as well in others. Actually two types of approaches have been developed to assess the EI construct: Self-assessment scales such as the Trait Meta-Mood Scale (TMMS; Salovey et al., 1995), and ability measures such as the Mayer-Salovey-Caruso Emocional Intelligence Test (MSCEIT; Mayer et al., 2002). The TMMS, which is employed in this study, considers three EI dimensions: 1) emotional attention, defined as the tendency of an individual to observe and think about their emotions and feelings, to value and examine, as well as to focus and maximize the emotional experience; 2) emotional clarity, which alludes the individual capacity to identify, distinguish, and describe the experimented emotions. This dimension is related to emotional attention, being easily to describe an emotion if previously it has received attention; and 3) emotional repair, considered as the ability to modify the emotional states, diminishing the influence of negative emotions by interrupting them as well as promoting or extending the influence of positive emotions (Fernández-Berrocal & Extremera, 2008). This last dimension is related to emotional clarity, as is difficult to interrupt a negative emotion or promote a positive emotion if this emotional state has not been previously identified.

To date, relationships between EI and sex, as well with several factors like physical exercise, subjective well-being and diverse psychological aspects have been shown (Fernández-Berrocal & Extremera, 2008; Tsaousis & Nikolaou, 2005). Sex differences indicate that women pay more attention to emotions while men have more abilities to regulate emotions (Fernández-Berrocal et al., 2004; Fernánez-Berrocal &

Extremera, 2008; Ruiz et al., 2012; Thayer et al., 2003). People with higher emotional attention show more physical symptoms (Goldman et al., 1996), as well as higher levels of depressive and anxiety symptomatology (Fernández-Berrocal et al., 2006; Salguero et al., 2012a). Higher levels of clarity and emotional repair are both negatively associated with neuroticism (Bastian et al., 2005) and have been proposed as good predictors of general health (Extremera & Fernández-Berrocal, 2002), greater satisfaction with life (Extremera & Fernández-Berrocal, 2005), higher perceived well-being (Chico-Librán et al., 2011; Fernánez-Berrocal et al., 2004; Landa et al., 2010; Salguero et al., 2012a), strategies for positive coping and global attributional styles for positive events (Gohm & Clore, 2002), greater self-esteem and interpersonal satisfaction (Salovey et al., 2002), lower vulnerability to stress (Salovey et al., 1995), as well as to suffer depression and anxiety (Extremera & Fernández-Berrocal, 2006; Fernández-Berrocal et al., 2006; Moriya & Takahashi, 2012; Stange et al., 2012) and develop personality disorders (Leible & Snell, 2004), and a better adaptation to stressful situations at work (Gohm et al., 2001).

This study explores for the first time the possible relationship between circadian typology, including also the neither-type group, and the three dimensions of EI (attention, clarity and emotional repair) using the TMMS in a large sample of Spanish healthy adults. Moreover, we analyze the possible interactions between sex and the weekly practice of physical exercise.

## MATERIALS AND METHODS

### Participants

Participants were 1011 adults, aged between 18 and 50 yrs (mean ± SD: 26.92 ± 6.53), of whom 362 (35.8%) were men and 649 (64.2%) women. No significant differences were observed in age between men (27.19 ± 6.77 yrs) and women (26.77 ± 6.40 yrs) ($t_{(1008)} = 0.98$; $p = .328$). Subjects were not paid for participating in the study, and they all gave their informed consent prior to the inclusion in the study. Subjects completed questionnaires of circadian typology and EI, as well as information about sociodemographic variables, presence or absence of physical or mental pathology and the weekly practice of physical exercise (yes/no) on-line. Only subjects who completed the questionnaires and do not present any health problems were included in the analysis. Of the total amount of 1304 subjects who participated, 293 (22.47%) were excluded due to failing the inclusion criteria (absence of physical and mental pathology which could affect the results, complete all the questionnaires, and age between 18 and 50 yrs). The present study complied with the tenets of the declaration of Helsinki and the International ethical standards of chronobiological research (Portaluppi et al., 2010).

**Measurement Instruments**

Circadian typology was assessed using the reduced Morningness-Eveningness Questionnaire (rMEQ), standardized for the Spanish population (Adan & Almirall, 1991). This test is composed of five items, and the total scores range from 4 to 25 points. Subjects could be assigned to one of the three possible circadian typologies (i.e., morning-, neither- or evening-type) according to the cutoff score: 4 to 11 points for the evening-type, 12 to 17 for the neither-type, and 18 to 25 points for the morning-type. The Spanish rMEQ is a reliable measure that shows high sensitivity in classifying subjects in the dimension of morningness-eveningness and has good convergent validity with other questionnaires that measure circadian typology (Caci et al., 2009). The

internal reliability of the rMEQ for the present sample was adequate (Chronbach's α = .77).

Emotional intelligence was evaluated with the Spanish Trait Meta-Mood Scale-24 (TMMS-24; Fernández-Berrocal et al., 2004). This scale is composed by 24 items, eight for each one of the dimensions which assess (emotional attention, emotional clarity and emotional repair). Items consist into a five-point Likert scale ranging from 1 (definitively false) to 5 (definitively true). The scores for each dimension range from 8 to 40. The TMMS-24 is a reliable measure with an adequate internal reliability for each one of their dimensions for the present sample with a Cronbach's α = .89 for emotional attention, .89 for emotional clarity, and .86 for emotional repair.

**Data Analysis**

The internal consistency of the scales was estimated using Cronbach's α coefficient. Pearson's correlations were computed between the three different dimensions of EI, as well as between these one and the direct scores on the rMEQ. Multiple analyses of covariance (MANCOVA) were performed considering the total score of each dimension of the TMMS-24 as a dependent variable and taking circadian typology, sex, and weekly practice of exercise as factors, while age was considered as a covariable to control for possible effects. The partial eta-square ($\eta_p^2$) was obtained as a measure of size effect, considering that a $\eta_p^2$ of .01 is small, .04 moderate, and .1 large (Huberty, 2002), and the observed statistical power for significant effects was greater than .6. Post-hoc comparisons were performed by Bonferroni's tests. Statistical analyses were performed using the SPSS/PC+ statistics package (version 17.0), and statistical tests were bilateral with type I error set at 5%.

**RESULTS**

The distribution of subjects in the circadian typology groups was 174 in the morning-type (17.21%; 50 men/124 women), 528 in the neither-type (52.23%; 186 men/342 women), and 309 evening-type (30.56%; 126 men/183 women). The distribution of total scores in the rMEQ was skewed toward eveningness ($z = 2.37$, $p < .001$). Moreover, the circadian typology groups differed significantly in age ($F_{(2,1008)} = 48.44$; $p < .001$; $\eta_p^2 = .88$). Post-hoc comparisons showed that morning-type subjects were older (31.03 ± 0.47 yrs) than neither-type (26.47 ± 0.27 yrs; $p < .001$) and evening-type (25.39 ± 0.36 yrs; $p < .001$) subjects.

Table 1 shows the correlation matrices of the three dimensions of the TMMS-24, as well as among them and the total rMEQ score. rMEQ scores showed a significant positive association with emotional repair, emotional attention displayed a significant positive association with emotional clarity, which showed a significant positive association with emotional repair.

Please insert here Table 1

The MANCOVA analyses revealed significant differences with regard to sex for two dimensions of the TMMS-24. Women presented higher averages scores in emotional attention ($F_{(1,998)} = 39.31$; $p < .001$; $\eta_p^2 = .038$), while men scored higher in emotional repair ($F_{(1,998)} = 4.48$; $p = .035$; $\eta_p^2 = .004$). See Table 2 for the descriptor parameters (average ± SEM) for men and women. Moreover, the MANCOVA analyses also showed significant differences with regard to weekly practice of physical exercise for emotional repair ($F_{(1,998)} = 20.70$; $p < .001$; $\eta_p^2 = .02$). Subjects who practiced physical exercise weekly exhibited higher scores (28.75 ± 0.31) as compared with those who did not practice (26.50 ± 0.93).

Please insert here Table 2

Circadian typology presented significant differences in the MANCOVA for all of the three dimensions of the TMMS-24: emotional attention ($F_{(2,998)} = 3.58$; $p = .028$; $\eta_p^2 = .007$), emotional clarity ($F_{(2,998)} = 5.84$; $p = .003$; $\eta_p^2 = .012$), and emotional repair ($F_{(2,998)} = 4.21$; $p = .015$; $\eta_p^2 = .008$). Post-hoc comparisons showed lower scores for morning-type in emotional attention compared with evening-type (-1.88, $p = .041$) and neither-type (-1.85, $p = .030$). Morning-type revealed higher scores than neither-type (1.89, $p = .016$) in emotional repair. Finally, neither-type scores in emotional clarity were lower than those of evening-type (-1.36, $p = .011$) and morning-type (-1.66, $p = .046$).

A significant interaction was found between circadian typology and sex in the dimension of emotional attention ($F_{(2,998)} = 4.45$; $p = .012$; $\eta_p^2 = .009$). Morning-type men showed lower scores than morning-type women, while in the neither-type and evening-type group there were no significant differences between men and women (see Figure 1).

Please insert here Figure 1.

## DISCUSSION

In this work we examined, for first time, possible relationships between circadian typology and EI in a large sample of healthy subjects with a good representation of both sexes, also including subjects belonging to the three circadian typologies. Distribution of subjects according to circadian-typology dimension, skewed to the eveningness pole, was in accordance with earlier studies using samples of young people and students (Adan et al., 2008, 2012; Adan & Natale, 2002).

The correlational analyses among the different dimensions of the EI are in concordance with previous data. Subjects with higher levels of emotional attention have

higher emotional clarity, while those individuals with higher ability to identify the emotions have a higher ability to interrupt negative emotional states and promote positive emotional states (Fernández-Berrocal et al., 2004; Fernández-Berrocal & Extremera, 2008, Ghom et al., 2005). That is, if we do not pay attention to emotions will be hard to identify them, as well as if we cannot identify them it would be very complicated to distinguish between those negative that should be interrupted and those positive which should be promoted. We highlight the positive association between rMEQ scores and emotional repair, a dimension considered as a good predictor of subjective well-being (Chico-Librán et al., 2011; Fernández-Berrocal et al., 2004; Landa et al., 2010; Salguero et al., 2012b). In this case, higher mornigness scores are linked to a higher ability to emotional repair and, consequently, with subjective well-being, as previous studies have showed by using different measurement instruments (Biss & Hasher, 2012, Jankowski, 2012; Lázar et al., 2012; Randler, 2008).

The sex differences showed are in accord with previous data (Fernánez-Berrocal & Extremera, 2008; Ruiz et al., 2012; Thayer et al., 2003). Women tend to be more focused on their emotional states and this style is not always healthy, especially when it is not followed by the enough ability to distinguish the causes and consequences of this emotional state neither with the ability to interrupt negative emotional states and promote positive emotional states. In addition, it has been observed that high levels of emotional attention with low levels of emotional clarity and emotional repair are associated with a higher vulnerability to develop ruminative thoughts, as well as depressive and anxiety symptomatology (Fernández-Berrocal & Extremera, 2008; Thayer et al., 2003), which are more prevalent in women (Kelly et al., 2008).

On the other hand, it is confirmed that the weekly practice of physical exercise is associated to higher levels of emotional repair (Li et al., 2009; Tsaousis & Nikolau,

2005). The physical exercise could improve the emotional manage also contributing to the increase in subjective well-being acting as a protective factor for the development of diverse psychological disorders. Although weekly practice of physical exercise is more common in morning-type than in evening-type (Urbán et al., 2011), as well as in men than in women (Fiala y Brázdová, 2000; Meyer et al., 2004), we did not find interactive effects in the scores of any EI dimension.

The circadian typology revealed differences in the three dimensions of EI. Morning-type subjects pay lower attention to the emotional states than evening-type and neither-type. Taking into account that higher levels of emotional attention are associated with the development of ruminative thoughts, as well as with depressive and anxiety symptomatology (Fernández-Berrocal et al., 2006; Salguero et al., 2012a), it would seem that morning-type subjects are into a less vulnerable, or protective, situation to face these disorders than neither-type and evening-type, as it has been suggested in previous studies (Adan et al., 2012; Hsu et al., 2012; Kitamura et al., 2010; Reid et al., 2012). In addition, the circadian typology modulates the results attributed to sex in emotional attention, where only morning-type men showed a lower level and, therefore, the possibility to be more resistant to affective and anxiety problems.

Nevertheless, in the emotional clarity dimension are both extreme groups (morning-type and evening-type) which showed a higher ability to identify, distinguish and describe the emotional states, as compared with the neither-type subjects. Moreover, morning-type and evening-type should have better coping strategies and a healthier attributional style (Gohm & Clore, 2002), greater general health (Extremera & Berrocal, 2002), greater subjective well-being (Chico-Librán et al., 2011; Fernández-Berrocal et al., 2004; Landa et al., 2010; Salguero et al., 2012a), and suffer less depressive and anxiety symptomatology (Extremera & Fernández-Berrocal, 2006;

Fernández-Berrocal et al., 2006; Moriya & Takahashi, 2012; Stange et al., 2012), as compared with neither-type. Although these conclusions should be taken with caution, the findings indicate a higher vulnerability to develop different psychological problems in the neither-type group. This result highlights the need to study the neither-type group not only due to the higher prevalence in the population, but also because it is not always situated into an intermediate position (Adan et al., 2012, Muro et al., 2009).

In the emotional repair dimension, morning-type subjects showed a higher ability to interrupt or promote emotional states, while neither-type showed the lower ability and evening-type are located into an intermediate position. Considering the relationship found between emotional repair and depressive symptomatology (Salguero et al., 2012a), anxiety and life satisfaction (Landa et al., 2006; Wong et al., 2007), as well as with mental health (Montes-Berges & Augusto, 2007), our results suggest a protective factor for the morning-type subjects in relation with the development of psychological problems, while the neither-type subjects seems to be the population with the highest vulnerability.

Several limitations for this study should be addressed in future research. The on-line data collection has a higher control absence compared to face-to-face studies. Likewise, the need of an internet connection to participate in the study could have limited the participation to those populations with fewer resources as well as to those which are not used to the new technologies. On the other hand, EI have been assessed with a self-reported instrument and it would be important that future studies examining the relationship between circadian typology and EI also employ EI ability instruments, as the MSCEIT.

The results emphasize to the morning-type as a protective factor for health and for the development of psychological problems (depression and anxiety specifically), and highlight the possible vulnerability of the neither-type, which could be higher than those of the evening-type. Further studies which include neither-type participants are required to examine their characteristics deeply. Circadian typology has showed differences in EI dimensions and taking in account both aspects the efficacy of prevention and treatment programs in the mental health field could be improved.

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Table 1. Correlations between Emotional Intelligence (EI) dimensions scores from Trait Meta-Mood Scale-24 as well as between those and reduced Morningness-Eveningness Questionnaire (rMEQ) scores.

| | rMEQ | Emotional attention | Emotional clarity |
|---|---|---|---|
| Emotional attention | -0.046 | | |
| Emotional clarity | -0.017 | 0.142** | |
| Emotional repair | 0.075* | -0.002 | 0.355** |

*$p < 0.05$; **$p < 0.001$.

Table 2. Descriptive statistics (mean ± SEM) for the scores in each Emotional Intelligence (EI) dimensions of Trait Meta-Mood Scale-24 according to sex and circadian typology groups

| | Sex | | Circadian typology | | |
|---|---|---|---|---|---|
| TMMS-24 | Men | Women | Morning | Neither | Evening |
| | (N = 365) | (N = 649) | (N = 174) | (N = 529) | (N = 311) |
| Emotional attention | 23.28 ± 0.45 | 26.58 ± 0.28 | 23.69 ± 0.64 | 25.54 ± 0.30 | 25.56 ± 0.38 |
| Emotional clarity | 27.98 ± 0.43 | 27.25 ± 0.27 | 28.27 ± 0.62 | 26.60 ± 0.29 | 27.96 ± 0.37 |
| Emotional repair | 28.15 ± 0.42 | 27.10 ± 0.27 | 28.66 ± 0.61 | 26.78 ± 0.28 | 27.44 ± 0.36 |

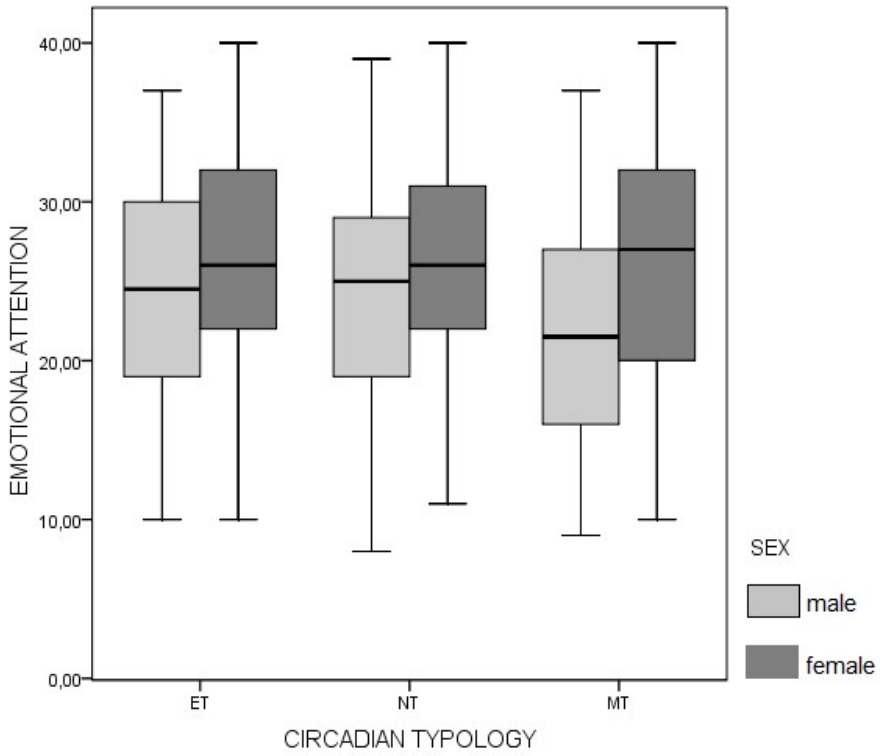


**FIGURE 1** Circadian typology (MT: morning-type, NT: neither-type, and ET: evening-type) and sex interaction in emotional attention dimension of the Trait Meta-Mood Scale-24. Scores range from 8 to 40.