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Relationship between chronotype and temperament/character among university students

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ABSTRACT

Chronotype is largely classified as being morning or evening types according to preference for daily activity and the preferred bedtime. This study examined the relationship between chronotype and temperament/character dimensions among university students. A total of 2857 participants completed the 140-item Temperament and Character Inventory-Revised Short version (TCI-RS) from a 5-score scale as well as the 13-item composite scale for morningness-eveningness (CSM). In this study, we classified chronotype as "morning," "neither," or "evening" types according to CSM scores and compared the scores in terms of 4 temperament dimensions and 3 character dimensions. The evening type showed high values for novelty seeking and harm avoidance, whereas the morning type had high scores for persistence, self-directedness, and cooperativeness. A logistic regression analysis after controlling for age and gender showed that chronotype significantly associated with persistence and novelty seeking. The results of this study suggest that chronotype is different according to gender and age and in addition, chronotype closely correlates with temperament and character. Among these, eveningness was associated with high novelty seeking, whereas morningness was associated with high persistence. Further studies are required to investigate the relationship between chronotype and temperament/character dimensions in a wider age bracket.

1. Introduction

Circadian rhythm is roughly a 24 h cycle in the body controlling various biological processes and responding to various external cues on a daily basis. Based on the preferred timing of behavior related to an individual's sleep-wake cycle, circadian preference is classified with chronotypes as being a "morning" type where socially accepted activity phase is advanced or an "evening" type where the phase gets left behind (Chung et al., 2009; Horne and Ostberg, 1976). Chronotypes have been associated with many behaviors and diseases, such as cardiovascular disease, type 2 diabetes, metabolic disorders, risk-taking behavior, cancer, psychiatric disorders, and even creativity (Adan et al., 2012; Foster et al., 2013).

The individual traits of morning and evening types are fundamentally based on human's physiological circadian rhythms, which are affected by sunlight and social life rhythms such as a social activity timetable (Jewett et al., 1991; Johnson and Spinweber, 1981; Liu et al., 2000; Wehr, 1991). In particular, these traits have been shown to be intrinsically biological ones that are influenced by generic factors (Dauvilliers et al., 2005; Linkowski et al., 1993; Ojeda et al., 2013).

According to a recent genome-wide association study of chronotypes in a large number of individuals, particular chronotypes share underlying genetic pathways with schizophrenia, educational attainment and possibly BMI. Furthermore, Mendelian randomization suggests that being an evening chronotype relates to a higher educational attainment (Lane et al., 2016).

It is also noted that the morning-evening circadian rhythms tend to undergo changes across the lifespan. Studies suggest that 4- to 11-year-old children are generally morningness oriented (Werner et al., 2009), and 12- to 14-year-old teenagers with pubertal maturation are

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gradually eveningness oriented (Carskadon et al., 1993). After the age of 14, there is a further shift toward eveningness. In adulthood, there is a shift into morningness again (Roenneberg, 2004). For adolescents, in general, sleep patterns on weekends show a considerable delay versus weekdays, since there are fewer restrictions in wake time on weekends.

Temperament and Character Inventory (TCI) is a battery of tests developed by C.R. Cloninger's psychobiological model of personality (Cloninger et al., 1993). Unlike other conventional personality tests, TCI is advantageous in that it can assess seven dimensions that reflect the two major components of an individual, temperament and character (Min et al., 2007), and using TCI can enable us to understand the process of personality development by classifying genetic and environmental factors that affect the personality development.

Cloninger's personality model could be usefully used to examine the relationship between personality and circadian preference because such model has a theoretical psychobiological basis (Cloninger, 1994) and circadian preference has strong biological and genetic bases (Adan et al., 2012). To date, previous studies have reported the association between chronotypes and temperament and character dimensions.

Studies on university students revealed that morning-type participants had lower values for novelty seeking but higher persistence scores (Adan et al., 2010; Caci et al., 2004; Park et al., 2014). Another study indicated that eveningness was associated with high harm-avoidance and novel seeking, but with low self-directedness in community-dwelling adults (Lee et al., 2014). In comparison, eveningness was negatively correlated with harm avoidance (Adan et al., 2010). Also, morningness was associated with high persistence and cooperativeness in adolescents (Randler and Saliger, 2011). Studies have also demonstrated a relationship between chronotypes and mental disease and symptoms (Adan et al., 2012; Antúnez et al., 2014), evening-type more vulnerable to the development of anxiety and affective problems (Antúnez et al., 2014).

As described above, to date consistent conclusions have yet to be made in studies with regard to chronotype and TCI. Therefore, the purpose of this study was to establish the relationship between chronotype and traits of temperament and character with the model of Cloninger for a sample of students in Korea, and it included a significant number of participants for both sexes.

2. Methods

2.1. Participants

This study was carried out on a relatively large sample size of 2857 university students participating in a questionnaire conducted at a public center in Kongju National University in 2013 as part of University Competence Empowerment Project (Park et al., 2016). Participants were informed of the confidentiality of the questionnaire and our intended purpose for the study and gave prior consent before being included in the study. Of the 2924 students, we analyzed the data covering 2857 participants after excluding 67 participants according to incomplete responses (lacking more than one item) for the questionnaires. The protocol of this study was approved by the Research Ethics Review Committee of Kongju National University.

2.2. Instruments

2.2.1. Temperament and Character Inventory (TCI)

Personality is an individual trait, formed through ceaseless interactions between biological and environmental factors (Cloninger et al., 1993). Cloninger's psychobiological theory of personality postulates that personality is composed of two-interrelated domains, temperament and character. Temperament is a relatively stable individual trait in behavior that is determined by inherent psychological factors such as genetic factors and procedural learning. In contrast, character can be defined as an individual trait that can be acquired through conscious learning via environmental and individual experience, but it undergoes continuous change (Cloninger, 1994).

TCI is an instrument developed based on Cloninger's psychobiological theory of temperament and character (Cloninger et al., 1993). It consists of four temperament dimensions: (novelty seeking, harm avoidance, reward dependence and persistence) and three character dimensions (self-directedness, cooperativeness and self-transcendence). These parameters can be briefly described as follows: “Novelty seeking” is the tendency to respond actively to novel stimuli, leading to pursuit of rewards that maintains behavior. “Harm avoidance” is the genetic tendency to inhibit or constrain responses to signals of dangerous or aversive stimuli. “Reward dependence” is the tendency for a positive response to social signals of reward (other people's facial expression or emotion). “Persistence” is the tendency to continuously maintain once rewarded behavior in the absence of sustained reinforcement. “Self-directedness” is the ability of an individual to control, regulate, and adopt his or her behavior to fit the situation in accordance with the individually chosen goals and values. “Cooperativeness” accounts for individual difference in the acceptance of other people. “Self-transcendence” is reviewed as the identification with everything conceived as being essential and consequential for a unified whole in universe and nature (Min et al., 2007).

In this study, we used the Temperament and Character Inventory-Revised Short version for adults (TCI-RS) whose reliability and validity was already validated (Min et al., 2007). The TCI-RS is a 140-item questionnaire and is assessed based on a 5-score scale. Internal reliability values of seven TCI-RS scales were as follows: novelty seeking=0.811, harm avoidance=0.877, reward dependence=0.817, persistence=0.857, self-directedness=0.876, cooperativeness=0.834, and self-transcendence=0.857.

2.2.2. Composite scale for morningness-eveningness (CSM)

The most common method to confirm the types of circadian rhythms is to classify them as morning or evening types by focusing on the behavior of the sleep-wakefulness cycle. For classification of chronotype, CSM is a self-reporting questionnaire developed by Smith et al. (1989) who improved the conventional morningness-eveningness questionnaire (Horne and Ostberg, 1976). The advantage of CSM is that it clearly represents the differences in alertness between morningness and eveningness, when compared to other instruments (Di Milia et al., 2013). The CSM consists of 3 items (1–5 scores) and 10 items (1–4 scores) for a total of 13 items. The morning-evening total score ranges from 16 to 55, with higher scores classifying participants as morning type, lower scores as evening type and mid-scores as intermediate type. In this study, we defined the percentiles 20/80 as cutoff criteria to classify individuals into three different chronotypes: “evening,” “neither,” and “morning” types (Prat and Adan, 2013). In the present sample, the scores corresponding to percentile 20/80 were 27 and 37; evening type (27 scores or less), morning type (37 scores or above), and neither type (between 27 and 37 scores) (Randler, 2008). We also used the Korean version of CSM whose reliability and validity was validated (Yoon et al., 1997); for this scale, the internal reliability value for the present sample was 0.796.

2.3. Statistical analysis

General characteristics of study participants across chronotypes were examined using frequency analysis and descriptive statistics. To verify the reliability of an instrument, Cronbach's α was computed as a reliability coefficient of internal consistency. Demographic data were analyzed using one-way analysis of variance (ANCOVA), chi-square test, and *t*-test. To check the total scores for CSM after controlling for gender and age, we performed ANCOVA, with CSM scores as dependent variable, gender as factor, and age as covariate as well as the interaction between gender and age. Multiple analysis of covariance (MANCOVA) was performed with each dimensional score of TCI-RS as