Associations of depression and seasonality with morning-evening preference: Comparison of contributions of its morning and evening components

Arcady A. Putilov*
Research Institute for Molecular Biology and Biophysics, Novosibirsk, Russia

A R T I C L E   I N F O

Keywords:
Morningness-eveningness
Chronotype
Sleep-wake pattern
Seasonal affective disorder
Anxiety
Somatization
Health

A B S T R A C T

Despite predominance of positive findings on associations of morning-evening preference with seasonality and depression, it remains to be clarified whether morning and evening components of this preference equally contribute to these associations and whether these associations persist after accounting for confounding variables. Data on retrospectively reported seasonal changes in well-being, mood, and behaviors were collected from 2398 residents of West Siberia, South and North Yakutia, Chukotka, Alaska, and Turkmenistan. Other self-reports included mental and physical health, sleep duration, and adaptabilities of the sleep-wake cycle. Depression was found to be linked to morning rather than evening component of morning-evening preference, i.e., morning lateness. Morning lateness was also linked to retrospectively reported degree of seasonal changes rather than to severity of problems associated with such changes. Variation in morning-evening preference explained not more than 2% and 4% of the total variation in depression and seasonality, respectively. The associations became even weaker but remained significant after accounting for other differences between respondents, such as their gender, age, physical health, and adaptability of their sleep-wake cycle. These results have practical relevance for understanding of the roles playing by morning earliness and insensitivity to seasonal changes in the environment to protection against different mood disorders.

1. Introduction

Seasonality and morning-evening preference represent two major domains of individual differences in adaptation of human mood, behavior and physiology to annual and diurnal changes in the natural and social environment. As early as in the end of the 19th century, Emil Kraepelin and his students have recognized that psychiatric disorders can be associated with evening preference and certain seasons of the year (see Becker et al. (2016), and Wehr (1989), respectively, for more details). A modern search for possibility of such associations has been initiated by description of the so-called Seasonal Affective Disorder (SAD) and beneficial results of its treatment with morning and evening bright light (Rosenthal et al., 1984b). A condition characterized by re-occurrence of depressive episodes in winter (winter depression or SAD of winter type) was related to a delayed circadian phase (Lewy et al., 1987) and to seasonal changes in availability of bright light in the early morning and late evening hours (Rosenthal et al., 1984b). Such attempts to consider winter depression in the theoretical framework of chronobiology led to prediction that depression is significantly linked to morning-evening preference and seasonality.

Seasonality is defined as individual's tendency to annual mood and behavioral variation, and it is often self-assessed retrospectively with the Seasonal Pattern Assessment Questionnaire or SPAQ (Rosenthal et al., 1984a). It was demonstrated that higher self-reported level of depression significantly correlated with higher amplitude of retrospectively reported seasonal changes (Putilov et al., 1994, 1999; Oyane et al., 2008). Moreover, higher seasonal fluctuations throughout seasons were related to mood disorders (Brambilla et al., 2012; Hakkarainen et al., 2003), evening preference (e.g., Baek et al., 2016; Murray et al., 2003; Zhang et al., 2015), and delayed sleep phase syndrome (Lee et al., 2011). However, negative findings were also reported. In the study of Natale et al. (2005), evening preference was found to correlate with seasonality scale in Italian but not Spanish sample. Moreover, Oginska and Oginska-Bruchal, (2014) did not reveal significant relationship between the SPAQ seasonality scale and a morning-evening preference.

Based on morning-evening preference people can be divided into chronotypes with different sleep-wake patterns (Kerkhof, 1998; Adan et al., 2012) and this preference is usually scored with unidimensional questionnaire instruments, such as the 19-item scale for self-assessment...
of morning-evening preference or MEQ (Horne and Östberg, 1976). In 1991, the MEQ was applied by Drennan et al. (1991) to show that clinically depressed individuals self-report significantly higher eveningness than the age- and sex-matched non-depressed controls. In a more recent study of a non-clinical sample of college students, Chelminski et al. (1999) found positive association between depressive symptoms and eveningness. A huge number of the following publications supported the results of these two studies and indicated potential vulnerability of evening types for depression (e.g., Caci et al., 2005; Mansour et al., 2005; Hirata et al., 2007; Ahn et al., 2008; Hidalgo et al., 2009; Wood et al., 2009; Kitamura et al., 2010; Merikanto et al., 2013; Prat and Adan, 2013; Fares et al., 2015). However, some of the reports do not unequivocally support the prediction that evening types are overrepresented among depressed individuals and such reports pointed at a possibility that association between chronotype and depression can be weakened or even disappear after accounting for confounding variables (Gaspar-Barba et al., 2009; Kim et al., 2010; Lemoiné et al., 2013; Müller et al., 2015, 2016).

It is also of importance to stress that factor analysis of the MEQ and even its shortened (six-item) version usually yields two or three factorial dimensions. The findings on the separate factors named “morning alertness” and “circadian preference for daily activities” emphasized the importance of separating between different dimensions of morningness-eveningness for testing its relationships with depressive symptoms (Kontinen et al., 2014). Most recently, Jankowski (2016) demonstrated differential relationship of morningness-eveningness dimensions with self-assessed depression. Indeed, as early as in 1991, we applied another questionnaire tool that allows self-assessment of morning and evening components of earliness-lateness on separate scales and found that the distance on the morning earliness-lateness scale between patients with winter depression and people from community samples equals approximately one standard deviation, whereas association with the evening earliness-lateness scale does not reach a statistically significant level (Booker et al., 1991). Analyses of samples drawn from several other populations also revealed a significant link between depression symptoms and morning lateness whereas a link between depression symptoms and evening lateness was non-significant in most of samples (Putlov et al., 1994). Similarly to the association between morningness-eveningness and depression, seasonality was found to be associated with the morning rather than evening scale of earliness-lateness (Putlov et al., 1994) and with a morning sub-scale of one of well-known morningness-eveningness scales named the “Composite Scale of Morningness” or “CSM (Jankowski, 2017).

To resume, despite numerous positive findings on relationships between individual differences in the domains of depression, seasonality, and morningness-eveningness, these relationships require further clarification. In particular, it remains to be examined whether differential relation of depression and seasonality to the morning and evening components of morningness-eveningness might be confirmed in analyses of a big dataset. These analyses permit control for possible influences of several other individual characteristics of respondents that was not considered in previous analyses of smaller datasets. Consequently, two hypotheses were examined in the present report. First, whether morning but not evening component of morningness-eveningness significantly contributes to the relationships of morningness-eveningness with depression or seasonality. Second, whether this contribution remains significant after accounting for differences between people in several other domains of individual variation including anxiety level, physical health, sleep duration, and adaptabilities of the sleep-wake cycle.

### 2. Methods

Data were collected in winter season from 2398 residents of West Siberia, South and North Yakutia, Chukotka, Alaska, and Turkmestan. Each respondent voluntarily agreed to participate in a questionnaire study of relationships between self-assessed sleep-wake patterns and health (Putlov et al., 1994, 1999). Table 1 contains a brief description of 6 regions (1A) were 12 samples were collected (1B). All West Siberian residents lived in Novosibirsk, the 3rd largest Russian city,

<table>
<thead>
<tr>
<th>Region</th>
<th>Samples</th>
<th>Latitude, degree North</th>
<th>Daylength, h:min</th>
<th>Temperature, °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Siberia</td>
<td>4 976</td>
<td>55</td>
<td>December: 7:10, June: 17:23</td>
<td>January: 16.5, July: 19.4</td>
</tr>
<tr>
<td>South Yakutia</td>
<td>2 511</td>
<td>60</td>
<td>December: 5:38, June: 19:09</td>
<td>January: 31.8, July: 16.9</td>
</tr>
<tr>
<td>North Yakutia</td>
<td>1 179</td>
<td>65</td>
<td>December: 2:22, June: 24:00</td>
<td>January: 34.4, July: 14.1</td>
</tr>
<tr>
<td>Chukotka</td>
<td>2 404</td>
<td>64 or &gt; 64</td>
<td>December: 3:57, June: 21:23</td>
<td>January: 14.3, July: 8.5</td>
</tr>
</tbody>
</table>

Notes: N: Numbers of samples; n: Numbers of respondents; December and June: The shortest and longest days of the year in these months; January and July: Averaged air temperature for these months. Mean scores for CES-D: Depression scored on the 20-item Center for Epidemiological Studies – Depression scale (Radloff, 1977), GSS: Score on 6-item Global Seasonality Scale, and Problem: A score ranging from 0 (no problem) to 5 (disabling problem) for response to a question asking whether seasonal changes are considered a problem (Rosenthal et al., 1984a); SD: Standard Deviation.
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