

Hiroyuki Toyama

Trait Emotional Intelligence and
Its Associations with Subjective
and Physiological Well-being



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Physiological Well-being

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Hiroyuki Toyama

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ABSTRACT

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The present thesis examined the association between trait emotional intelligence (EI) and well-being (subjective well-being [SWB] and physiological well-being) among Japanese participants (eldercare nurses and undergraduate university students). This research had four primary goals: First, to identify profiles of trait EI and to investigate their association with SWB (Study I); second, to examine the role of trait EI in the process of SWB (Study II); third, to investigate the association of trait EI with psychological state and physiological well-being in a laboratory-based stress induction condition (Study III); and fourth, to investigate the association of trait EI with affect and physiological well-being in the process of recovery in day-to-day life (Study IV). Three different datasets were used. For Studies I and II, cross-sectional data were collected from Japanese employees ($N = 500$). Study III investigated a sample of 28 undergraduate Japanese students. Study IV utilized short-term longitudinal data randomly sampled from Japanese employees ($N = 50$) who had participated in the previous questionnaire survey (Studies I and II). The research yielded three primary results. First, an analysis based on the person-centered approach revealed six distinct profiles of trait EI. In general, the profiles in which all ability dimensions showed higher values were associated with lower burnout, lower depression, and higher work engagement, whereas the profiles in which all ability dimensions showed lower values were linked to more adverse outcomes. In addition, the trait EI profile characterized by the highest values for all ability dimensions, although lower for interpersonal skills, showed the best outcomes, and the trait EI profile combining moderate intrapersonal EI, high interpersonal EI, and low situational EI relatively poorer outcomes. Second, the results showed that trait EI fueled work engagement by enhancing social support, which in turn resulted in improved creativity. Moreover, trait EI interacted with social support: when trait EI was moderate or high, social support improved work engagement, which in turn stimulated creativity. Third, the results revealed that persons with higher trait EI showed better psychological state and more adaptive autonomic activity in both an experimental stress condition and a naturalistic situation compared to their lower trait EI peers. These findings enrich our understanding of the role of trait EI in promoting well-being and highlight the significant importance of trait EI as a personal resource for human flourishing and success in positive psychology.

Keywords: trait emotional intelligence, positive psychology, subjective well-being, work-related well-being, physiological well-being

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TIIVISTELMÄ (FINNISH ABSTRACT)

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Piirreperohjainen tunneäly ja sen assosiaatiot subjektiiviseen ja fysiologiseen hyvinvointiin

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Tämä väitöskirjatutkimus tarkasteli tunneälyn (emotional intelligence) ja hyvinvoinnin (koettu ja fysiologinen) välisiä yhteyksiä japanilaisilla hoitoalan työntekijöillä sekä yliopisto-opiskelijoilla. Tutkimuksella oli neljä päätavoitetta: (1) etsiä tunneälyn profiileja ja analysoida niiden yhteyksiä koettuun hyvinvointiin (osatutkimus I), (2) tutkia tunneälyn roolia koetun hyvinvoinnin prosessissa (osatutkimus II), (3) analysoida tunneälyä koetun ja fysiologisen hyvinvoinnin kannalta kokeellisessa stressitilanteessa (osatutkimus III), ja (4) selvittää tunneälyn roolia hyvinvoinnissa palautumisen näkökulmasta päiväkirja-aineistossa (osatutkimus IV). Tutkimus perustuu kolmeen eri aineistoon. Osatutkimukset I ja II perustuvat japanilaisilta hoitajilta kerättyyn poikkileikkausaineistoon ($N = 500$). Osatutkimus III pohjautuu kokeelliseen asetelmaan, joka toteutettiin japanilaisilla yliopisto-opiskelijoilla ($N = 28$). Osatutkimus IV hyödynsi päiväkirja-asetelmaa ($N = 50$) ja se toteutettiin hoitoalalla. Väitöskirjatutkimus osoitti kolme päätulosta. Ensinnäkin aineistosta löytyi kuusi erilaista tunneälyn profiilia. Yleisesti ottaen korkeat arvot kaikissa tunneälyn profiileissa olivat yhteydessä korkeampaan koettuun hyvinvointiin (alhaisempi työuupumus ja masentuneisuus sekä korkeampi työnimu). Vastaavasti matalat tunneälyn profiilit liittyivät heikompaan hyvinvointiin. Toiseksi havaittiin, että tunneäly ennusti korkeampaa työnimua sosiaalisen tuen kautta (tunneälykkäät hankkivat enemmän tukea), ja korkeampi työnimu sen sijaan lisäsi luovuutta työssä. Tunneälyn ja sosiaalisen tuen yhteisvaikutus havaittiin keskeiseksi: kun tunneäly oli korkeampaa, sosiaalinen tuki edisti työnimua, mikä puolestaan edisti luovuutta työssä. Kolmanneksi, tulokset osoittivat, että tunneälykkäillä oli korkeampi koettu hyvinvointi ja adaptiivinen autonominen vaste/aktiivisuus (fysiologisen hyvinvoinnin kuvaajana) sekä kokeellisessa stressitilanteessa että luonnollisissa työolosuhteissa (hoitotyössä). Kaiken kaikkiaan nämä tutkimustulokset osoittavat, että tunneäly voi toimia merkittävänä hyvinvointia edistävänä persoonallisuuden voimavarana.

Avainsanat: tunneäly, positiivinen psykologia, koettu hyvinvointi, työhyvinvointi, fysiologinen hyvinvointi

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LIST OF ORIGINAL PUBLICATIONS

- I Toyama, H., & Mauno, S. (2016). A latent profile analysis of trait emotional intelligence to identify beneficial and risk profiles in well-being and job performance: A study among Japanese eldercare nurses. *International Journal of Work Organisation and Emotion*, 7(4), 336–353.
- II Toyama, H., & Mauno, S. (2017). Associations of trait emotional intelligence with social support, work engagement, and creativity in Japanese eldercare nurses. *Japanese Psychological Research*, 59(1), 14–25.
- III Toyama, H., Yajima, J., & Onoda, A. (2014). The effect of trait emotional intelligence on psychophysiological stress response induced by mental stress testing. *Behavioral Science Research*, 52(2), 109–123.
- IV Toyama, H., & Mauno, S. (2017). Trait emotional intelligence, self-reported affect, and salivary alpha-amylase on working days and a non-working day. *Japanese Psychological Research*, 59(4), 275–287.

Taking into account the instructions and comments suggested by the co-authors, the first author of this dissertation created research questions and hypotheses, collected all data sets in Japan (for four sub-studies), conducted the data analyses, and wrote the reports of four original sub-studies as the first author.

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1 INTRODUCTION

Positive psychology offers a complementary perspective to the traditional approach of psychological research biased towards the pathological model (Seligman & Csikszentmihalyi, 2000). The central proposition of positive psychology is that to describe human functioning fully, psychological research should also focus on the individual potentials and strengths that contribute to personal flourishing. In accordance with this proposition, the positive psychology approach places an emphasis on the study of personal and environmental resources (Seligman & Csikszentmihalyi, 2000), including positive subjective experiences (e.g., well-being, flow), beneficial personality traits (e.g., interpersonal skills, high ability), and institutional factors (e.g., work ethic, civility). This dissertation focused on a psychological construct that forms “an integral part of positive psychology” (Bar-On, 2010, p. 54), that is, emotional intelligence.

Emotional intelligence (EI) has been increasingly recognized as a key psychological resource for human flourishing and healthy living. A body of meta-analyses have established that EI is a salient promotor of subjective well-being (Peña-Sarrionandia, Mikolajczak, & Gross, 2015; Sánchez-Álvarez, Extremera, & Fernández-Berrocal, 2016), as well as perceived health (Martins, Ramalho, & Morin, 2010; Schutte, Malouff, Thorsteinsson, Bhullar, & Rooke, 2007). There is also promising evidence to show that EI is malleable through training, and that the empowerment it bestows benefits human functioning and well-being (Kirk, Schutte, & Hine, 2011; Ruiz-Aranda et al., 2012; Slaski & Cartwright, 2003). Thus, it is worth exploring the adaptive potential of EI in the context of positive psychology.

The present thesis focused on the nexus between trait EI and well-being at both the psychological level and the physiological level. Specifically, the primary goals of this study were, first, to identify profiles of trait EI and to investigate their relationship with subjective well-being (Study I); second, to explore the role of trait EI in the process of subjective well-being (Study II); third, to investigate the associations of trait EI with psychological and physiological responses to laboratory-based stress induction (Study III); and fourth, to examine the con-

nection of trait EI to self-report affect and physiological well-being in the cycle of stress and recovery in day-to-day life (Study IV).

The present research was based on samples of Japanese participants. In fact, research on EI and well-being has mostly been conducted in Western countries, with relatively low levels of activity elsewhere (e.g., Gökçen, Furnham, Mavroveli, & Petrides, 2014). Japan, an Asian country, is no exception. Full-scale research on EI has only recently been undertaken in Japan.

1.1 Definition and conceptual models of EI

The concept of EI was introduced into the field of psychology by John D. Mayer and his colleagues during the period from the late 1990s to early 2000s (e.g., Mayer & Salovey, 1997; Mayer, Salovey, & Caruso, 2004; Mayer, Salovey, Caruso, & Sitarenios, 2001; Salovey & Mayer, 1990). Salovey and Mayer (1990) defined EI as “a subset of social intelligence that involves the ability to monitor one’s own and others’ feelings and emotions, to discriminate them and to use this information to guide one’s thinking and actions” (p. 189). In a later article, they refined the definition, stating that “the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth” (Mayer & Salovey, 1997, p. 10). Essentially, EI is a *hot intelligence* responsible for the processing of highly significant information for the individual such as emotions, personality, and social relationships, as opposed to cool intelligence which is based on reasoning about verbal-linguistic, logical-mathematical, and visual-spatial information (Schneider, Mayer, & Newman, 2016).

Contemporary research is dominated by two major conceptual models of EI that stem from the distinct measurement approach, that is, ability EI and trait EI (Petrides, 2011). Ability EI is thought to be best assessed by using cognitive performance measures, an approach analogous to IQ testing where an individual’s performance of cognitive tasks is assessed within a specific time limit. Trait EI, in turn, is assessed, in accordance with the tradition of personality assessment, by using a typical performance measure such as a self-report questionnaire. The difference between ability EI and trait EI in their operationalization, demonstrates that they are heterogeneous constructs (Petrides, 2011). Ability EI indicates a person’s genuine cognitive ability to process emotional information at the maximum level (i.e., the level to which the person can effectively process emotions in real-life situations) and has been shown to share a great deal of variance with crystallized intelligence (Davis & Humphrey, 2012), whereas trait EI describes a person’s typical understanding of their emotional abilities (i.e., the degree to which a person believes that he or she can effectively process emotions) and tends to show more significant overlaps with basic (the Big Five) personality traits (Davis & Humphrey, 2012).

My focus in this dissertation is on the concept of *trait EI*, and for three primary reasons. First, trait EI, responsible for the implementation of adaptive coping, may be of a more central significance for achieving well-being (Davis & Humphrey, 2014; Salovey, Bedell, Detweiler, & Mayer, 1999). Second, the concept of trait EI, measured by means of a self-report questionnaire, conforms to the logic of personality assessment (Petrides, 2011). On the other hand, operationalizing the concept of ability EI may be problematic owing to the considerable difficulty of creating tasks able to evaluate a person's emotional ability in a truly objective manner (Petrides, 2011). Third, trait EI has shown incremental validity in the prediction of a wide variety of affective criteria (Andrei, Siegling, Aloe, Baldaro, & Petrides, 2015) as well as distinctive validity in its association with higher-order (the Giant Three and Big Five) personality taxonomies (Petrides, Pita, & Kokkinaki, 2007).

In the next section, the conception of trait EI is described in more detail.

1.1.1 Trait EI

Trait EI is defined as an individual's typical perceptions, experiences, and tendencies concerning their abilities to perceive, express, understand, and regulate emotions with the aim of promoting personal well-being and adaptability (Petrides, 2010; Petrides et al., 2016). Trait EI refers to a composite of the emotional aspect of personality, which is operationalized using self-report questionnaires (Petrides, 2011; Petrides et al., 2016; Petrides et al., 2007). This conception of EI enables ones to reasonably link the construct to established personality theories (e.g., the five-factor theory of personality; McCrae & Costa, 1999) and existing scientific models of differential psychology. Thus, it affords a sensible basis for fathoming the constructs and the relevant knowledge stemming from self-rating type questionnaires (Petrides, 2011; Petrides et al., 2007).

To date, various EI self-report questionnaires have been developed to assess EI from different angles. Among those often used in research are the Trait Emotional Intelligence Questionnaire (TEIQue; Petrides, 2009), the Schutte Self-Report Emotional Intelligence Scale (SSREIS; Schutte et al., 1998), the Emotional Quotient Inventory (EQ-i; Bar-On, 1997), the Trait Meta Mood Scale (TMMS; Salovey, Mayer, Goldman, Turvey, & Palfai, 1995), the Wong and Law Emotional Intelligence Scale (WLEIS; Law, Wong, & Song, 2004; Wong & Law, 2002), the Profile of Emotional Competence (PEC; Brasseur, Grégoire, Bourdu, & Mikolajczak, 2013), and, in Japan, the Emotional Intelligence Scale (EQS; Otake, Shimai, Uchiyama, & Utsuki, 2001; Uchiyama, Shimai, Utsuki, & Otake, 2001). In general, when operationalized using self-report questionnaires, EI is typically termed *trait EI*. Although some researchers tend to use other terminology, such as emotional competence (Brasseur et al., 2013), emotional-social intelligence (Bar-On, 2006), and characteristic EI (Schutte, Malouff, Simunek, McKenley, & Hollander, 2002), these are interchangeable with *trait EI* (see also the view of Schutte et al., 2007).

In my research, trait EI was assessed by using the EQS and the WLEIS, both of which are introduced in more detail in the methods section.

Next, I present the theoretical framework of the present research.

1.2 Theoretical framework

1.2.1 The theory of EI in the context of well-being

The theory of EI posits that people differ in their capacity to recognize, process, and manage their own and others' emotions, and to utilize this information to promote well-being and adaptation (Mayer & Salovey, 1997; Mayer, Salovey, & Caruso, 2008; Petrides et al., 2016; Salovey & Mayer, 1990; Zeidner, Matthews, & Roberts, 2012). Emotionally intelligent people are better able to perceive their feelings and emotions. They are sufficiently sensitive and open to various emotional experiences of the self and, if necessary, are able to access these in order to take advantage of the information they contain (Mayer & Salovey, 1997; Salovey & Mayer, 1990; see also Peña-Sarrionandia et al., 2015).

This positive attribute allows them to carry out optimal and efficient management of emotions (Peña-Sarrionandia et al., 2015; Salovey & Mayer, 1990; see also Szczygiel & Mikolajczak, 2017). In the face of stressors and other emotional interference, they tend to utilize adaptive emotion coping, such as appraising the situation as a challenge instead of a threat (Mikolajczak & Luminet, 2008), striving to retain self-efficacy (Schutte et al., 2002), and harnessing more positive coping methods (Saklofske, Austin, Galloway, & Davidson, 2007) at the earliest possible stage of the trajectory of emotion regulation (Peña-Sarrionandia et al., 2015; see also Salovey et al., 1999; Zeidner et al., 2012). Owing to the sophisticated strategy of emotion management, emotionally intelligent individuals are more likely to experience positive emotions and less likely to be mired in negative emotions. Since such positive emotionality contributes to broadening people's momentary thought-action repertoires and facilitating the construction of permanent personal resources against stress and adversity (see the broaden-and-build theory; Fredrickson, 1998, 2001, 2013), these individuals tend to achieve a greater sense of well-being (Salovey & Mayer, 1990; Zeidner et al., 2012).

It is, however, important to realize that emotionally intelligent people do not regulate emotions merely to gain immediate affective comfort. On the contrary, they do so for the sake of their real objectives and personal growth (e.g., undertaking an emotionally demanding work task for career development), with a good understanding of its transient consequences (Mayer & Salovey, 1997; Salovey & Mayer, 1990). If emotional regulation is a requirement in the process, they may even attempt to up-regulate their negative emotions or down-regulate their positive emotions (see the argument by Peña-Sarrionandia et al., 2015).

As opposed to these individuals, emotionally non-intelligent persons can be described as those who find it difficult to effectively perceive, process, and regulate their feelings and emotions (Mayer, Salovey, & Caruso, 2002; Salovey

& Mayer, 1990). They tend to have a narrow view on intrapersonal affective phenomena, avoid feeling emotions, and thus even find it hard to generate a mood that may help to promote well-being and adaptation (Mayer et al., 2002). Since these passive attributes impede the development of an emotionally healthy and fulfilling life, these individuals are more likely to suffer from emotional distress, resulting in lowered well-being (Salovey & Mayer, 1990).

Emotions which are processed by EI include information about the individual's association with his or her environments (Lazarus, 1991; Mayer et al., 2004). In the interpersonal context, emotions play a significant role in communication (Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006). Thus, the theory of EI includes an interpersonal perspective that links emotional abilities to social functioning (Salovey & Mayer, 1990; Zeidner et al., 2012). Explicitly, the theory assumes that high capacity to process emotions and emotion-laden information facilitates the gaining of insight into others' emotional experiences and better managing them, leading to even better socio-emotional skills and competences (Salovey & Mayer, 1990; Zeidner et al., 2012). Individuals who have good social capacity are more likely to improve social engagement, interpersonal relationships, supportive social networks, and the utility of social resources (e.g., social support; see Salovey et al., 1999), thereby attaining greater socio-emotional well-being (*the interpersonal mechanism*; Zeidner et al., 2012).

1.3 Defining well-being

1.3.1 Subjective well-being in work

Subjective well-being (SWB) is an inclusive term that refers to peoples' global evaluations about their lives (Diener et al., 2017; Diener, Scollon, & Lucas, 2009). In other words, SWB indicates the extent to which person's life is good and impeccable (Diener et al., 2017). In the literature, SWB is conceptualized from two distinct perspectives of human philosophy, hedonia and eudaimonia. Hedonia is based on the view that people strive to minimize emotional dysphoria and pursue emotional euphoria (Carver, Lawrence, & Scheier, 1996; Tatarkiewicz, 1976). Accordingly, the hedonic perspective of well-being focuses on peoples' positive experiences in their life such as the sense of pleasure, happiness, and satisfaction (Diener et al., 2017; Diener et al., 2009). Eudaimonia is descended from the Aristotelian idea that a kernel of truly satisfactory life is to actively strive to develop ones' potentials in accordance with one's personal criteria (Deci & Ryan, 2008). As such, the eudaimonic perspective of well-being focuses on human prosperity such as personal growth, personal expressiveness, self-actualization, and meaning in life (Deci & Ryan, 2008).

In the field of occupational psychology, research has focused primarily on the hedonic perspective of well-being, that is, affective well-being and psychosomatic well-being (Sonnetag, 2015). Affective well-being refers to emotional pleasantness, organizational commitment, job satisfaction, and the lack of emo-

tional exhaustion, and psychosomatic well-being describes the absence of psychosomatic symptoms of distress (Van Horn, Taris, Schaufeli, & Schreurs, 2004). In this thesis, my focus was on affective well-being, a dimension which constitutes the central aspect of SWB at work (Warr, 2007). Specifically, two work-related aspects of SWB, work engagement (Study I and II) and burnout (Study I), were studied.

Work engagement is defined as an active and gratifying job-relevant state of mind which is marked by vigor, dedication, and absorption (Schaufeli, Salanova, González-Romá, & Bakker, 2002). Vigor refers to an experience of high levels of energy during work and mental elasticity when faced with job-related adversities. Dedication describes a sense of strong involvement in work and an experience of “significance, enthusiasm, inspiration, pride, and challenge” (Schaufeli et al., 2002, p. 74). Absorption refers to an experience of high concentration on and preoccupation with work, where people have a feeling that time passes rapidly and it is difficult to detach from work. Some studies have suggested that work engagement may be a salient promotor of employee well-being and work performance (Bakker, Schaufeli, Leiter, & Taris, 2008; Halbesleben, 2010; Reis, Hoppe, & Schröder, 2015).

Burnout is defined as a psychological syndrome of chronic stress stemming from work (Maslach, Schaufeli, & Leiter, 2001). In research, burnout has been conceptualized as a multi-dimensional construct comprising three significant symptoms, emotional exhaustion, depersonalization (or cynicism), and reduced personal accomplishment (Maslach et al., 2001). Emotional exhaustion, a core component of burnout (Cox, Tisserand, & Taris, 2005), refers to the depletion of emotional resources and mental energy. Depersonalization represents a self-protective mechanism through which an individual seeks to attain an emotional and cognitive distance from the current workload and is accompanied with an increase in emotional exhaustion. Reduced personal accomplishment indicates a loss or attrition of a sense of work-related professional efficiency and achievement. Research has recognized burnout as a grave psychological reaction that leads to deleterious consequences, for example, psychosomatic illnesses (Toppinen-Tanner, Ahola, Koskinen, & Väänänen, 2009), sickness absence (Ahola et al., 2008), and turnover intentions (Leiter & Maslach, 2009).

In addition to these two factors, the present research studied depression as an additional indicator of employee well-being (Study I). Depression refers to a psychological state manifested as either gloomy mood or loss of interest or pleasure (DSM-IV; American Psychiatric Association, 2013). Previous studies have shown that depression is a nosologically analogous entity to burnout (Bianchi, Schonfeld, & Laurent, 2015) and shares a large amount of variance with the components of burnout (e.g., Hakanen & Schaufeli, 2012). On the other hand, it has been pointed that depression is differentiated from burnout in that typically it indicates negative experiences regardless of the cause, whereas burnout describes chronic stress stemming from the individual’s social and organizational contexts (Bianchi et al., 2015). Moreover, depression has been shown to be factorially distinct from burnout (e.g., Hakanen & Schaufeli, 2012;

Hakanen, Schaufeli, & Ahola, 2008; see also the review by Bianchi et al., 2015). Cross-lagged longitudinal studies have suggested that depressive symptoms may be predicted by burnout over time, but not *vice-versa* (Hakanen & Schaufeli, 2012; Hakanen et al., 2008).

1.3.2 Physiological well-being: Physiological stress systems

The global wellness of the organism is affected by the functioning of two physiological systems activated by stress: the autonomic nervous system (ANS) and the hypothalamic-pituitary-adrenal (HPA) axis. The ANS is a neurophysiological mechanism which comprises the sympathetic nervous system and the parasympathetic nervous system. The ANS is highly sensitive to stressors and responsible for the fight-or-flight response (Cannon, 1929). Recognition of stressors triggers the secretion of catecholamines (epinephrine and norepinephrine). Epinephrine and norepinephrine are released mainly from the medulla of the adrenal gland and sympathetic nerves, respectively (Andrews, Ali, & Pruessner, 2013). The circulation of catecholamines in the body leads to various physiological changes (e.g., upsurge in cardiovascular and respiratory activity, reduction in gastrointestinal tract functioning, and peripheral vasoconstriction) aimed at supplying energy to the organism to maintain the acute stress reaction (Andrews et al., 2013; Appelhans & Luecken, 2006; Pruessner & Ali, 2015). The ANS stress reaction is ephemeral. Once the stressor becomes ineffective or is over, it quickly returns to the baseline level (Pruessner & Ali, 2015).

The HPA axis is involved in the serial neuroendocrinological stress response. The HPA axis reacts to a stressor more slowly than the ANS (Andrews et al., 2013). When stress is perceived, whether in a direct or indirect (e.g., anticipative) manner, the paraventricular nucleus of the hypothalamus releases corticotrophin-releasing hormone (CRH). CRH, in turn, stimulates the release of adrenocorticotrophic hormone (ACTH) from the anterior pituitary gland; ACTH in turn spurs the adrenal cortex to secrete glucocorticoids (Pruessner & Ali, 2015). The overall stress reaction terminates with the negative feedback of glucocorticoids to the secretory organs of CRH and ACTH (Pruessner & Ali, 2015). The stress reaction of the HPA axis returns to the baseline level around one hour after the stressor is over (Andrews et al., 2013).

Although these physiological systems react to stress in tandem (Andrews et al., 2013; Pruessner & Ali, 2015), the interest of the present research was in the ANS, an entity which has received little attention in EI research. Specifically, I focused on two biomarkers of the ANS: heart rate variability (Study III) and salivary alpha-amylase (Study IV).

Heart rate variability (HRV) represents the fluctuation in heartbeat over a given period of time (Appelhans & Luecken, 2006) and has been recognized as a proximal indicator of cardiac vagal modulation (Quintana et al., 2016). In research, HRV is quantified using electrocardiography, and the data are often processed using power spectral analysis. By this means, it is possible to divide HRV into two oscillatory constituents, one high frequency and the other low frequency (Appelhans & Luecken, 2006). The high frequency (HF) constituent is

peak power which emerges in the frequency band from 0.15 to 0.40 Hz, and it reflects parasympathetic or vagal activity attributed to respiratory sinus arrhythmia (Sawada, 1999). A predominance of HF indicates the state of being relaxed (Yajima, Ogata, & Kawano, 2010) and is related to cardiovascular health (Thayer, Yamamoto, & Brosschot, 2010). The low frequency (LF) constituent is a power spectrum which appears in the frequency band from 0.04 to 0.15 Hz, and it represents an aggregation of sympathetic and parasympathetic activities in the heart and vascular system (Sawada, 1999). The ratio of LF to HF (LF/HF) is interpreted as a surrogate of the sympatho-vagal balance in general (e.g., Appelhans & Luecken, 2006). An increase in LF/HF indicates elevated sympathetic activity and a concomitant reduction in parasympathetic activity (Kemp et al., 2010).

Salivary alpha-amylase (sAA) is a metalloenzyme which belongs to family 13 of the glycosyl hydrolase (Nater & Rohleder, 2009). The primary function of sAA is to hydrolyze glycosidic linkages to convert amylose and amylopectin in carbohydrates to glucose, maltose, and oligosaccharide (Nater & Rohleder, 2009). Previous studies have revealed that sAA has a unique pattern of diurnal secretion that sharply decreases within 30 minutes or so after waking, and then gradually increases throughout the day (e.g., Out, Granger, Sephton, & Segerstrom, 2013). Recently, sAA has attracted attention, again in stress research, and its utility, mainly as an indicator of sympathetic activity, has been increasingly demonstrated (Nater & Rohleder, 2009; Out et al., 2013). Previous studies have shown that higher sAA predicts psychological distress and anxiety-related psychopathology (e.g., Marchand, Juster, Lupien, & Durand, 2016; Schumacher, Kirschbaum, Fydrich, & Ströhle, 2013), whereas decreased sAA contributes to affective well-being (e.g., Doane & Van Lenten, 2014; Steptoe, Wardle, & Marmot, 2005).

1.4 Trait EI and well-being: Empirical evidence

1.4.1 Trait EI and SWB

A recent meta-analysis, conducted by Sánchez-Álvarez et al. (2016), provided strong evidence that EI is associated with SWB. Specifically, the authors examined the relations of three types of EI (ability EI, self-report ability EI, and self-report mixed EI) based on the distinct measurement method with general SWB (positive and negative emotions, subjective happiness, and life satisfaction) in 25 studies with a total of 8 520 participants and 77 effect sizes. The results revealed that all types of EI were significantly positively associated with general SWB. Notably, the association was shown to be stronger for trait EI (self-report ability EI and self-report mixed EI) than ability EI. Similar results have been reported in meta-analytic studies on EI and self-report health. A meta-analysis by Schutte et al. (2007) of 35 studies with a total of 7 898 English participants with 44 effect sizes found that trait EI is twice to three times more strongly posi-

tively associated with mental (e.g., anxiety, depression), physical (e.g., physical pain), and psychosomatic health (e.g., combination of psychological and physical problems) than ability EI. These findings were further replicated in the meta-analysis by Martins et al. (2010), which included empirical studies published since Schutte et al. (2007).

Empirical studies have also reported significant relationships between trait EI and more specific types of SWB, such as work-related SWB. For example, Zysberg, Orenshtein, Gimmon, and Robinson (2016) investigated the effect of trait EI on burnout among daycare-center employees. The result showed that trait EI serves as a buffer against symptoms of burnout. More importantly, the positive contribution of trait EI was retained even after controlling for the effect of the Big Five personality traits and work position. A study using a sample of hospital nurses, conducted by Mikolajczak, Menil, and Luminet (2007), also reported that trait EI significantly and negatively predicted burnout over and above the Big Five personality traits. In addition, some studies excluding the effects of other typical confounding factors, such as job demands (Lorente, Salanova, Martínez, & Schaufeli, 2008), self-efficacy (Durán, Extremera, Rey, Fernández-Berrocal, & Montalbán, 2006), and perceived stress (Durán et al., 2006), have also shown trait EI to act as a buffer against burnout.

The benefits of trait EI for promoting positive work-related SWB have also been reported by a few studies. For example, Sy, Tram, and O'Hara (2006) investigated the cross-sectional association between trait EI and job satisfaction among food service employees. The authors found that trait EI had a significant positive effect on job performance that was independent of the higher-order personality taxonomies. Likewise, Akhtar, Boustani, Tsivrikos, and Chamorro-Premuzic (2015) reported a cross-sectional study, using a large sample of workers from various occupations, in which trait EI positively predicted employee engagement over and above the Big Five personality traits, personal demographics, and work-specific personality. Altogether, these findings suggest that trait EI may be an aspect of personality which is of unique importance for human well-being.

1.4.2 Trait EI and SWB: Variable-centered approach vs. Person-centered approach

Quantitative research on trait EI has used two types of analytic approach. One is the variable-centered approach, and another is the person-centered approach. Including the studies reviewed above, most extant studies on EI are based on the variable-centered approach, which focuses on relationships among the study variables (Laursen & Hoff, 2006). In this framework, the group of individuals of interest is regarded as homogeneous when studying the association between two or more variables. Research using this analytic approach is, therefore, seeking to understanding how one variable is related to another variable or other variables (Laursen & Hoff, 2006). Analyses based on this perspective include correlation analysis, ANOVA, and regression analysis (Laursen & Hoff, 2006; Muthén & Muthén, 2000). The person-centered approach in turn focuses

on relationships among individuals (Laursen & Hoff, 2006). This approach investigates differences between individuals in the patterns of the study variables. The goal of research adopting this analytic approach is to identify distinct subgroups of the population by categorizing individuals based on commonalities in the pattern of the study variables (Laursen & Hoff, 2006). Typical analyses based on this approach are cluster analysis and latent profile analysis (Muthén & Muthén, 2000).

In EI research, a few studies have used the person-centered analytic approach. For example, Gerits, Derksen, Verbruggen, and Katzko (2005) sought to identify profiles of trait EI among nurses by using hierarchical cluster analysis and, further, to examine the associations of the profiles with burnout, absenteeism, and job turnover. The researchers found seven distinct profiles of trait EI for each gender and investigated their specific significant association with burnout. The result showed that for female nurses, a high-trait EI profile with weak interpersonal skills was associated with the lowest burnout, but a low-trait EI profile with strong interpersonal skills was related to the highest burnout. For male nurses, a high-trait EI profile with strong problem-solving skills and stress-tolerance was associated with the highest personal accomplishment, while a moderate-trait EI profile in which these abilities were weaker was related to the lowest personal accomplishment. Finally, they argued that, for female nurses, relatively low emotional skills in the social domain may serve as a buffer against burnout by enabling them not to be overly involved in their clients' emotions. For male nurses, in turn, high emotional abilities in the intrapersonal domain may be key in mitigating a reduced sense of work-related professional efficacy and achievement (Gerits et al., 2005).

Keefe, Parker, and Wood (2012) documented a six-year follow-up study in which the relationship between trait EI profiles and graduation outcomes was investigated among undergraduate students. Using latent profile analysis, they found five different profiles of trait EI. Their subsequent analyses further revealed that a low-trait EI profile with marked weakness in interpersonal skills and stress management showed the highest risk for school withdrawal.

As these studies show, the use of the person-centered approach has a unique advantage in examining trait EI, which is composed of multiple distinct emotional abilities. The use of this analytic approach allows researchers to identify distinct patterns in the scoring of the components of trait EI which may be undetectable with the traditional variable centered approach. However, in EI research, since only a handful of studies have utilized the person-centered analytic approach so far, our understanding of the nexus between trait EI profile and well-being remains meager. Thus, in the present thesis, this gap was addressed by exploring the profiles of trait EI and examining their associations with SWB (Study I).

1.4.3 Trait EI and the process of SWB in the work context

The job demands-resources (JD-R) model provides a useful description of the process of work-related SWB (Demerouti, Bakker, Nachreiner, & Schaufeli,

2001; Schaufeli & Taris, 2014). The basic premise of this model is that job characteristics are divided into two categories: job demands and job resources. Job demands are defined as “those physical, social, or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs” (Demerouti et al., 2001, p. 501). Excessive job demands generate a situation where employees need to strive harder to achieve work objectives. This accelerates the expenditure of energy resources and leads to strain (symptoms of burnout). If the strain is accumulated and aggravated, it increases the susceptibility to health disturbance and reduced work productivity (health impairment process) (Demerouti et al., 2001; Schaufeli & Taris, 2014).

Job resources refer to “those physical, social, or organizational aspects of the job that may do any of the following: (a) be functional in achieving work goals; (b) reduce job demands and the associated physiological and psychological costs; (c) stimulate personal growth and development” (Demerouti et al., 2001, p. 501). Job resources motivate persons intrinsically to make an effort to perform work tasks by satisfying fundamental human needs such as autonomy, relatedness, and competences (Schaufeli & Taris, 2014). For example, appropriate feedback from others stimulates motivation of learning and enhances a sense of capability of work. Moreover, job resources function as extrinsic motivators as well, since work environments rich in resources stimulate the volition to strive to attain work goals (Schaufeli & Taris, 2014). Thus, the acquisition of multiple job resources promotes work engagement, which ultimately improves job performance and organizational commitment (a motivational process).

In recent research, the JD-R model has been expanded by taking personal resources into account (Bakker, Demerouti, & Sanz-Vergel, 2014; Schaufeli & Taris, 2014; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2007, 2009). Personal resources refer to positive self-evaluations that are connected to resilience and persons’ sense of their capacity to successfully control and operate upon their environment (Hobfoll, Johnson, Ennis, & Jackson, 2003). Positive self-evaluation fosters a greater sense of concordance between one’s own criteria (e.g., ideals, interests, and value) and one’s personal goals (Judge, Bono, Erez, & Locke, 2005). Individuals who realize high self-goal concordance are more likely to be encouraged to achieve their objectives, as well as having a greater sense of satisfaction (Judge et al., 2005). As such, the function of personal resources resembles that of job resources. Richer personal resources encourage individuals to engage in their work, promote adaptive coping with job stress, and bolster personal growth (Bakker et al., 2014; Schaufeli & Taris, 2014; Xanthopoulou et al., 2007, 2009).

While the personal resources focused on in the context of the JD-R model include such constructs as self-efficacy, self-esteem, and optimism (e.g., Xanthopoulou et al., 2007, 2009), an additional personal resource may be trait EI (e.g., Garrosa, Moreno-Jiménez, Rodríguez-Muñoz, & Rodríguez-Carvajal, 2011; Schutte & Loi, 2014; Williams, Wissing, Rothmann, & Temane, 2009). Research has revealed that the effects of trait EI in work agree with those of personal re-

sources in the context of the JD-R model (see Schaufeli & Taris, 2014). First, *personal resources may impact on the perception of job characteristics, which further affects work-related SWB* (Schaufeli & Taris, 2014). For example, Schutte and Loi (2014) examined two mediation models by using structural equation modeling. One model was that trait EI is linked to mental health (depression and anxiety) via social support and perceived power in the workplace. Another was that trait EI is related to work engagement via the same mediators. They found that trait EI enhances satisfaction with social support, which in turn improves both mental health and work engagement. Similar findings were reported by Kong, Zhao, and You (2012a), who examined the role of self-esteem and social support in the relationship between trait EI and life satisfaction in a Chinese sample. The results revealed that both self-esteem and social support serve as a mediator of the positive impact of trait EI on life satisfaction. Moreover, their other study, conducted among Chinese students, showed that social support also plays a mediating role in the link between trait EI and psychological distress (Kong, Zhao, & You, 2012b). Analogously, a study with a sample of Chinese teachers showed trait EI mitigated burnout by increasing the availability of organizational support (Ju, Lan, Li, Feng, & You, 2015).

Second, *personal resources may moderate the link between job characteristics and well-being* (Schaufeli & Taris, 2014). Empirical evidence on the moderating role of trait EI is limited. Mahon, Taylor, and Boyatzis (2014) examined how trait EI is associated with organizational-level job resources, including shared vision (e.g., "I feel inspired by our vision and mission"), shared positive mood (e.g., "This is a great place to work"), and perceived organizational support in the prediction of organizational engagement. They found that trait EI interacted with a shared vision and perceived organizational support: the higher the trait EI, the stronger the positive association between these job resources and organizational engagement. Several other studies have reported analogous interactions between trait EI and other job resources, such as goal congruence with supervisors (De Clercq, Bouckennooghe, Raja, & Matsyborska, 2014) and growth opportunities (Williams et al., 2009), to positively affect work engagement.

Although limited, evidence has also been found of the moderating role of trait EI in the relationship with the health impairment process of the JD-R model. A study by Lee and Ok (2012), using a large sample of athlete coaches, found that trait EI interacts with emotional job demands (surface acting of emotional labor) to predict burnout. The results showed that higher, more than lower, trait EI suppresses the growth of burnout by alleviating the detrimental effect of emotional job demands. Likewise, a study among nurses, carried out by Görgens-Ekermans and Brand (2012), reported a moderating effect of trait EI on the link between job stress and emotional exhaustion, with higher trait EI mitigating the influence of job stress on emotional exhaustion more than lower trait EI.

In sum, these findings suggest that trait EI mobilizes the potential of job characteristics, which, in turn, promotes SWB; moreover, trait EI conditions the effect of job characteristics on SWB in a positive direction. Thus, it seems that

trait EI contributes linearly and interactively to the process of SWB. However, research on the indirect association between trait EI and SWB in the context of work is still in the process of development. Since research in this field so far has emphasized the intrapersonal mechanism, we know only little about the interpersonal mechanism. Thus, the present research has sought to address this gap.

Specifically, the study concentrated on the process through which trait EI affects work engagement via social support (i.e., *the interpersonal mechanism*; Zeidner et al., 2012 [see the section on the theory of EI, p. 16]). In the theory of EI, social support – social resources provided by supportive relationships in daily living (Gottlieb & Bergen, 2010) – is described as a central psychosocial factor linking the construct to well-being (Salovey et al., 1999; Salovey & Mayer, 1990; see also, Zeidner et al., 2012). As presented above, several studies have provided evidence to bolster the mediating role of social support (Kong et al., 2012a, 2012b; Schutte & Loi, 2014). The present research went one step further by considering creativity as an outcome of the interpersonal mechanism. The construct here was defined as creative behavior which refers to “the set of interdependent observable and unobservable activities that occur in response to a nonalgorithmic task or project and that purportedly constitute the creative process” (Montag, Maertz, & Baer, 2012, p. 1365). It is noteworthy that creativity was shown to be a positive antecedent of affective well-being, and *vice versa* (Amabile, Barsade, Mueller, & Staw, 2005). The present research also attempted to extend the earlier studies (Kong et al., 2012a, 2012b; Schutte & Loi, 2014) by exploring both the linear and interactive contributions of trait EI to the interpersonal mechanism. Consequently, one aim of this thesis was to investigate the role of trait EI in the process of SWB (Study II).

1.4.4 Trait EI and physiological well-being

Several studies have suggested that trait EI is related to well-being not only at the psychological level but also at the physiological level. The first physiological study of EI was undertaken by Salovey, Stroud, Woolery, and Epel (2002), who investigated the association of trait EI with neurophysiological (systolic blood pressure) and neuroendocrinological (salivary cortisol) responses in a stress condition. They found a negative correlation of trait EI with systolic blood pressure and salivary cortisol reactions to acute psychosocial stress challenges. Several later studies, using laboratory-based stress manipulation, provided further evidence on the nexus between trait EI and physiological well-being. For example, Laborde, Brüll, Weber, and Anders (2011) investigated whether trait EI was associated with autonomic reactivity to negative mood induction among 30 handball athletes. The results showed that athletes with higher trait EI manifested a lower autonomic reaction (LF/HF ratio) to a negative visual stimulus combined with unpleasant sound than those with lower EI. Mikolajczak, Roy, Luminet, Fillée, and de Timary (2007) examined the association of trait EI with mood and salivary cortisol reactions to a psychosocial stress loading (the Trier Social Stress Test: TSST; Kirschbaum, Pirke, & Hellhammer, 1993) in the sample of 59 students. The researchers found less mood aggravation to the stress stimu-

lus and lower salivary cortisol secretion throughout the experiment in students with higher trait EI compared to their lower trait EI peers. Moreover, an additional analysis revealed that trait EI significantly and negatively predicted the variance of mood and salivary cortisol responses, even after adjusting for the effect of the Big Five personality traits, social desirability, and alexithymia. In a similar vein, a more recent experimental study, adopting the TSST for stress induction, detected a unique contribution of trait EI to the variance of salivary cortisol reaction across age and state anxiety (Laborde, Lautenbach, Allen, Herbert, & Achtzehn, 2014).

The physiological benefit of trait EI has also been reported in studies implemented in more neutral condition. For example, Ruiz-Robledillo and Moya-Albiol (2014) investigated how trait EI is linked to self-report health and cortisol awakening response (CAR) among 68 caregivers of offspring with autism spectrum disorders over two consecutive days. The researchers found that individuals who scored higher on trait EI (higher ability to clarify and repair moods) showed better self-report health and lower magnitude of CAR than those who scored lower on trait EI (lower ability to clarify and repair moods). Further, they found that CAR plays a mediating role in the positive impact of trait EI (the ability to clarify and repair moods) on self-report health. Mikolajczak, Bodarwé, Laloyaux, Hansenne, and Nelis (2010) examined the relationship between trait EI and cortical electrophysiological activity in a sample of 31 healthy young adults. They found a positive correlation of trait EI with the activity of the frontal cortex in the resting condition, with higher trait EI displaying greater left frontal activation relating to emotional pleasantness (Tomarken, Davidson, Wheeler, & Doss, 1992) and faster recovery from stress (Jackson et al., 2003).

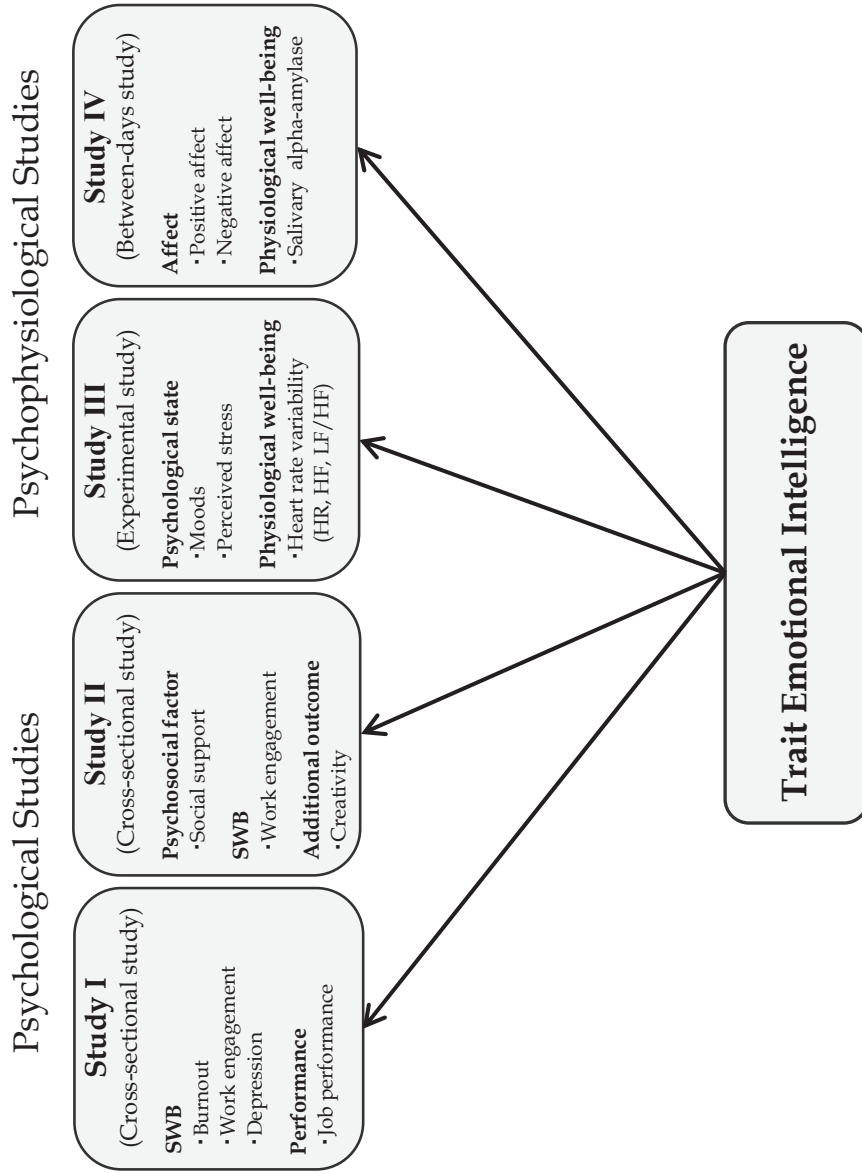
To summarize, these findings suggest that trait EI may lead to better physiological well-being and that the benefits of trait EI may occur both in a stress condition and in a more neutral situation. Moreover, evidence showing the incremental contribution of trait EI to physiological well-being adds to the adaptive significance of the construct, thereby contributing substantial value to physiological EI research. Despite this, investigation of the physiological effect of trait EI remains under-researched, and only a handful of evidence exists. Evidence on the relationship between trait EI and, in particular, the ANS is scarce. To the best of my knowledge, only two studies have investigated the links between the trait EI and the indicators of ANS activity (for reviews, see Laborde et al., 2011; Salovey et al., 2002). Thus, the present dissertation sought to contribute to filling this gap in the research with two studies: an experimental study (Study III) and a field study (Study IV).

1.5 Research purposes and hypotheses

The primary purpose of my research was to investigate the association between trait EI and well-being at the psychological (SWB) and physiological (physiological well-being) level among Japanese participants. Specifically, the first aim

was to identify profiles of trait EI and to investigate the association between these profiles and SWB (work engagement, burnout, and depression) (Study I: a cross-sectional field study). The second aim was to examine the role of trait EI in the SWB process where social support influences work engagement and creativity in that sequential order (Study II: a cross-sectional field study). The third aim was to investigate the link of trait EI with psychological (moods, perceived stress) and autonomic (HRV) responses to laboratory-based stress induction (Study III: an experimental study). The fourth aim was to examine the connections of trait EI to self-reported affect (positive affect, negative affect) and autonomic activity (sAA) in a cycle of stress and recovery in daily life (Study IV: a day-to-day field study). FIGURE 1 provides an overview of the present research.

FIGURE 1 Overview of the present research



The research hypotheses of each study are as follows:

Study I: A latent profile analysis of trait emotional intelligence to identify beneficial and risk profiles in well-being and job performance: A study among Japanese eldercare nurses

Hypothesis 1: H1

Since trait EI is composed of various distinct emotional abilities, latent profile analysis will reveal different trait EI profiles.

Hypothesis 2: H2

Trait EI profiles with a higher overall trait EI dimension will be associated with better subjective well-being and higher job performance.

Hypothesis 3: H3

Trait EI profiles with lower interpersonal EI compared with the other EI dimensions within the profile will also be associated with better outcomes.

Hypothesis 4: H4

Trait EI profiles with lower overall trait EI dimension scores will be associated with poorer well-being and lower job performance.

Hypothesis 5: H5

Trait EI profiles with higher interpersonal EI compared with other EI dimensions within the profile will also be associated with poorer outcomes.

Study II: Associations of trait emotional intelligence with social support, work engagement, and creativity in Japanese eldercare nurses

Hypothesis 6: H6

Trait EI shows a positive, direct relationship with social support, WE, and creativity.

Hypothesis 7: H7

Social support shows a positive, direct relationship with WE and creativity.

Hypothesis 8: H8

Trait EI is positively associated with creativity via WE.

Hypothesis 9: H9

Trait EI moderates the relationship between social support and WE. WE is higher when both trait EI and social support are high.

Hypothesis 10: H10

A conditional effect of social support on creativity is mediated by WE. In this relationship, creativity is stronger when trait EI is high (see Figure 1 in original publication II).

Study III: The effect of trait emotional intelligence on psychophysiological stress response induced by mental stress testing

Hypothesis 11: H11

Individuals scoring higher on trait EI will show a lower level of autonomic (HRV) response to laboratory-based acute stress induction than those scoring lower on trait EI.

Hypothesis 12: H12

Individuals scoring higher on trait EI will display better autonomic (HRV) recovery following stress than those scoring lower on trait EI.

Study IV: Trait emotional intelligence, self-reported affect, and salivary alpha-amylase on working days and a non-working day

Hypothesis 13: H13

Individuals with higher trait EI will show higher positive affect and lower negative affect than individuals with lower trait EI.

Hypothesis 14: H14

Individuals with higher trait EI will show a lower level of diurnal sAA than individuals with lower trait EI.

2 METHODS

2.1 Participants and procedure

Study I and Study II (questionnaire field study with cross-sectional design)

The data used in Study I and Study II were collected from Japanese employees engaging in eldercare nursing in April 2014. I recruited eldercare nurses from 28 randomly selected intensive care homes for the elderly that were officially registered by a prefecture in Japan. A set of questionnaires, a description of the purpose of the research, and instructions were distributed to 500 potential participants through the managers of each care center. We asked the nurses to fill in several questionnaires (trait EI, personal and occupational demographics, burnout, work engagement, social support, creativity, depression, and job performance) in their free time. The surveys were retrieved one month later in an annual nurses' athletics festival. Of the original 500 employees, 494 completed the questionnaire survey, yielding a total response rate of 98.8%.

Study III (psychophysiological experimental study)

In Study III, the data were gathered as part of a psychophysiological stress research project (JSPS KAKENHI 24530902), which had been conducted from May to August 2012. Based on the field-experimental study paradigm, we first carried out a questionnaire-based field study among Japanese undergraduate students, in which participants' trait EI was assessed with the Japanese version of the Wong and Law Emotional Intelligence Scale (WLEIS). Next, the participants were categorized into a high trait EI group and low trait EI group by using the mean of the WLEIS. We then randomly chose 15 healthy individuals from each group for a laboratory-based stress experiment. Finally, except for two students in the high trait EI group who declined participation, 28 students (high trait EI group: $n = 13$ [male: $n = 7$, female: $n = 6$], age = 21.4 years, $SD = 6.2$; low trait EI

group: $n = 15$ [male: $n = 9$, female: $n = 6$], age = 20.7 years, $SD = 4.5$) completed the experimental study.

The stress experiment was carried out according to the protocol established by Yajima (2012). This protocol consists of three main phases: an anticipation phase lasting 10 min, a task (stress loading) phase lasting 10 min, and a recovery phase of 30 min. Just before starting the experiment, the manager of this research project informed the participants that they would be facing several challenging mental tasks in this experiment. After that, the participants were guided to room A to rest for 10 min (the anticipation phase).

Next, the participants were invited to enter room B, where two experimenters, seated in armchairs were awaiting them. The experimenters introduced themselves as experts in cognitive behavioral analysis and announced to participants that their behaviors and performance of the mental tasks would be recorded and evaluated by the two experimenters in real time. One of the experimenters then switched on the video recorder in front of the participants, and two types of mental stress tasks (a public speech and a mental arithmetic) were administered for 5 min each. For the public speech, a topic was randomly chosen from three alternatives by the experimenters (e.g., "Please speak about your future vision, concretely"). Participants were asked to think about the topic (2 min) and speak about it as concretely as possible (3 min). To maximize the effectiveness of the stress task, the participants were not informed of these time limits. During this challenging task, whenever a participant fell silent or finished speaking before the end of the 3 min, the experimenters applied pressure on the participant by saying, while maintaining a neutral facial expression, "You still have time left to speak about the topic, please continue".

Following the public speech task, the participants were administered a mental arithmetic task (5 min). Here, the participants were instructed to subtract 3 from 1 072 consecutively as fast and as accurately as possible. Whenever a participant provided the wrong solution, the experimenters required them to rework the calculation from the beginning (i.e., starting at 1 072). As with the public speech task, participants were not informed of the time allocated for the task or the time remaining. After finishing the stress tasks, participants were led back to room A to rest (recovery phase lasting 30 min). The examiners concluded the experiment by debriefing the participants.

The participants evaluated own mood at the end of each phase and perceived stress immediately after the anticipation and task phases. For trait EI, we utilized the participants' WLEIS scores recorded in the previous field survey conducted in May 2012. The variation in autonomic activity (HRV) was continuously monitored throughout the experiment in a non-invasive way.

Study IV (psychophysiological between-day field study)

The data used in Study IV were collected from April to July 2015 from 50 healthy eldercare nurses working in an intensive care home for the elderly. The nurses were randomly selected from the participants in our previous research

conducted in April 2014 (Study I and Study II). Of the initially selected 50 participants, 45 completed all the phases of the study, yielding a total response rate of 90.0 %. The study was implemented in a naturalistic (neutral) situation over three consecutive days: working day 1 (daytime shift); a non-working day; and working day 2 (daytime shift). Working day 1 was defined as the next day after at least four successive working days on the daytime shift. Prior to the investigation, participants were instructed to refrain from habits and behaviors which could affect their autonomic activity: smoking, intense physical activity, drinking coffee and alcohol were prohibited for at least 3hr before saliva sampling, and eating and brushing the teeth were forbidden during the 40 min immediately before data collection.

Participants practiced the method of saliva sampling and measurement according to the manufacturer's manual (Nipro Co. Ltd., Japan) for a few days. They were then instructed to sample their own saliva specimen by inserting a filter paper under the tongue for about 30s and measure their sAA (kIU/L) using a portable salivary amylase monitor (Nipro Co. Ltd., Japan) at 08:30, 12:00, and 18:00 on each study day (for a review, see Harmon, Towe-Goodman, Fortunato, & Granger, 2008). Participants were also instructed to fill in questionnaires on their day-level affect after the last saliva measurement on each day. For trait EI, the scores of the Emotional Intelligence Scale (the EQS) obtained from the participants in our previous studies conducted in April 2014 (i.e., Study I and Study II) were utilized.

In all studies, participation was voluntary, and all participants gave their informed consent before study start.

More information on the participants and research procedures of these studies can be found in the original articles appended to this dissertation.

2.2 Measures

The psychological measures and biological measures used in my research are described below. Details on the Cronbach's alphas and more information on the scales can be seen in the original articles. All scales showed acceptable reliabilities ($\alpha \cong .81$).

2.2.1 Psychological measures

Trait EI was measured with two self-report questionnaires: the Emotional Intelligence Scale (EQS; Otake et al., 2001; Uchiyama et al., 2001) and the Wong and Law Emotional Intelligence Scale (WLEIS; Law et al., 2004; Wong & Law, 2002). The EQS was used in Study I (a cross-sectional field study), Study II (a cross-sectional field study), and Study IV (a day-to-day field study), and the WLEIS was used in Study III (an experimental study).

The EQS is a measure of EI developed in Japan (Otake et al., 2001; Uchiyama et al., 2001). The scale consists of 63 items (except for two items evaluating the reliability of participants' responses to the other questions) assessing three dimensions of trait EI: intrapersonal EI, interpersonal EI, and situational EI (21 items for each dimension). The structure and example items of the EQS are presented in TABLE 1.

Intrapersonal EI refers to the capacity to recognize, use, understand, and manage emotions of ones' own that assist in thinking and acting effectively. Interpersonal EI indicates the capacity to be aware of and manage others' feelings and emotions that are involved in the maintenance of good social relationships. Situational EI describes the capacity to gain insight into changes in environments, to take the initiative based on appropriate judgment of situations, and to manage the use of the emotional capabilities in the intrapersonal and interpersonal EI dimensions which are present in the prevailing circumstances. The EQS has been widely used (e.g., Fujino, Tanaka, Yonemitsu, & Kawamoto, 2015; Kitahara & Bohgaki, 2012) and has demonstrated satisfactory psychometric utility (internal consistency, test-retest reliability, factorial validity, constructive validity) in Japanese samples from a wide range of occupations (Otake et al., 2001; Shimai, Otake, Utsuki, & Uchiyama, 2001; Uchiyama et al., 2001). The items were rated from 0 (*totally disagree*) to 4 (*totally agree*).

TABLE 1 Description of the EQS

Dimensions	Corresponding factors	Sub-factors	Example Items
Intrapersonal EI	Self-awareness	Emotional awareness	I am aware of changes in my feelings.
	Self-motivation	Self-efficacy	I am able to clearly express in words my present feelings.
		Perseverance	When I begin a project, I carry it to completion.
	self-control	Enthusiasm	I like to find significant value in any task that I do.
		Self-decision	If necessary, I can make decisions on my own.
		Impulse control	I am able to keep calm and not raise my voice even when I am offended.
Interpersonal EI	Empathy	Patience	I am determined to achieve my goals.
		Sharing positive emotion	I am careful not to say anything that would hurt someone else's feelings.
	Altruism	Sharing negative emotion	When I see someone in trouble, I feel like helping him.
		Personal consideration	I always think how I can make someone happy.
	Interpersonal relationship	Voluntary support	When I see someone in distress, I cannot help talking to him.
		Personal management	I am able to bring out the best in others.
		Sociability	I can get along with anyone without attempting to please everyone.
		Cooperation	I am willing to help anyone.
	Situational awareness	Decision making	I do not hesitate to express my opinions at critical moments.
		Optimism	I always see the positive side of an issue or challenge.
Leadership		Group consideration	I value my friends and associates from many years ago.
		Influence	I am capable of being a leader in a group situation.
Flexibility		Risk management	I try to be alert for changes when making future plans.
		Tactfulness	I cope successfully with change.
	Adaptability	I fit in fairly well in a different environment.	

The WLEIS (Law et al., 2004; Wong & Law, 2002) was translated into Japanese and validated by Toyota and Yamamoto (2011). This scale consists of 16 items that cluster into four major ability domains of EI (four items in each domain): self-emotion appraisal (SEA), others' emotion appraisal (OEA), use of emotion (UOE), and regulation of emotion (ROE). SEA refers to the ability to perceive and understand ones' own emotions and display them adequately. OEA refers to the ability to capture and comprehend others' feelings and emotions. UOE describes the ability to utilize emotional information that leads to constructive behaviors and high performance. ROE refers to the ability to regulate one's own emotions, and is involved in recovery from stress and adversity. This scale was used in experimental research on EI among Japanese participants (e.g., Nozaki & Koyasu, 2013). The items were scored on a 7-point scale from 1 (*totally disagree*) to 7 (*totally agree*). TABLE 2 shows the composition of the WLEIS along with example items.

TABLE 2 Description of the WLEIS

Domains	Example items
Self-emotion appraisal	I have a good sense of why I have certain feelings most of the time. I have good understanding of my own emotions.
Others-emotion appraisal	I always know my friends' emotions from their behavior. I am a good observer of others' emotions.
Use of Emotion	I always set goals for myself and then try my best to achieve them. I always tell myself I am a competent person.
Regulation of Emotion	I am able to control my temper so that I can handle difficulties rationally. I am quite capable of controlling my own emotions.

Three justifications can be offered for the use of the EQS and the WLEIS in the present research. First, there is emerging evidence to show that trait EI and relevant competencies are affected by cultural norms and values (e.g., Gökçen et al., 2014; Koydemir, Şimşek, Schütz, & Tipandjan, 2013; Matsumoto, 1990). Therefore, at the present stage, it may be prudent to assess trait EI in Japanese samples with questionnaires developed in Japan or other countries with a similar culture (i.e., collectivist). Note that the WLEIS was initially developed in China and validated in the samples of Chinese participants whose culture is based on collectivism (Law et al., 2004; Wong & Law, 2002).

Second, both measures are free from items overlapping with well-being. For example, the TEIQue (Petrides, 2009), a mainstream questionnaire used in EI research, contains an oblique factor labeled “well-being”, the items of which directly assess well-being (e.g., “I frequently have happy thoughts”; “On the whole, I’m pleased with my life”). The application of such a scale would be problematic in the present research because it fosters substantial overlap between the constructs.

Third, these scales have a specific practical advantage in research. The EQS contains two items aiming to detect false reactions by respondents to the other items (“Even when I fail at a task I absolutely never lose my temper”; “I try to put myself in other people's shoes”). Researchers can utilize these items to identify and exclude unreliable samples from analyses, thus making it possible to obtain more reliable results. With respect to the WLEIS, this scale with only a small number of items can assess the significant components of EI with satisfactory accuracy (Toyota & Yamamoto, 2011). Thus, by using this scale, it is possible to improve the efficiency of research in tandem with reducing the burden on participants.

Burnout (Study I) was measured using the 17-items of the Japanese Burnout Scale (Tao & Kubo, 1992), which was developed by reference to the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981). This scale assesses three major symptoms of burnout during the past six months (note that in this instance the time period is not that of the MBI), emotional exhaustion (e.g., “I feel I am stressed out mentally and physically”), depersonalization (e.g., “I feel I don’t want to see my colleagues’ and patient’s faces”), and personal accomplishment (e.g., “I feel pleasure from the bottom of my heart after completing my tasks”). The items were scored on a 5-point Likert scale from 1 (*never*) to 5 (*always*).

Work engagement (Study I and Study II) was assessed by the Japanese translation of the Utrecht Work Engagement Scale (Shimazu et al., 2008). This scale comprises 17 items which measure three core components of work engagement, vigor (e.g., “At my job, I feel strong and vigorous”), dedication (e.g., “I am enthusiastic about my job”), and absorption (e.g., “I am immersed in my work”). The items were scored on a 6-point Likert scale from 0 (*never*) to 6 (*always*).

Depression (Study I) was assessed with the Zung Self-Rating Depression Scale (Zung, 1986). This scale comprises 20 items concerning depressive symp-

toms. Of the 20 items, 10 are positive statements (e.g., “I feel hopeful about the future”), and the other 10 items negative statements (e.g., “I feel down-hearted and blue”). The items were scored on a 4-point Likert scale ranging from 1 (*a little of the time*) to 4 (*most of the time*).

Social support (Study II) was measured with nine items of the New Brief Job Stress Questionnaire (New BJSQ; Inoue et al., 2014). The total score indicates one’s perception of social support from superiors, co-workers, and family/friends (e.g., “How much can you count on your superior when you encounter difficulties?”). The items were rated on a 4-point Likert scale from 1 (*never*) to 4 (*very*).

Job performance (Study I) was measured using three items concerning subjective work performance (e.g., “I did my work better than others this month”) drawn from the New BJSQ (Inoue et al., 2014). The items were rated on a 4-point Likert scale from 1 (*totally disagree*) to 4 (*totally agree*).

Creativity at work (Study II) was measured using three items on the realization of creativity (e.g., “I made improvements and demonstrated creativity in my work”) drawn from the New BJSQ (Inoue et al., 2014). The response scale ranges from 1 (*totally disagree*) to 4 (*totally agree*).

Mood (Study III) was measured with the Japanese translation of the UWIST Mood Adjective Checklist (Okamura, Tsuda, & Yajima, 2004). This scale comprises 20 items, 10 of which assess present mood, energetic arousal (e.g., “active”, “vigorous”) and tense arousal (e.g., “anxious”, “jittery”). The response scale ranges from 1 (*definitely not*) to 4 (*definitely*).

Perceived stress (Study III) was measured with 22 items of the Dundee Stress State Questionnaire (Matthews et al., 2002; Matthews et al., 1999), which measures stress state syndromes of task engagement (e.g., “I was determined to succeed on the task”), distress (e.g., “I felt tense”), and worry (e.g., “I felt concerned about the impression I was making”). Responses were scored from 0 (*disagree*) to 4 (*agree*).

Daily affect (Study IV) was measured with the Three-Dimensional Checklist of Affect (Joh, 2008). Positive affect was defined as an aggregation of vigor (e.g., “energetic”), excitement (e.g., “eagerly”), and relaxation (e.g., “feel easy”). Negative affect was defined as a composite of exhaustion (e.g., “tired”), depression (e.g., “sad”), and tense (e.g., “nervous”). The items were rated on a 7-point Likert-type scale from 1 (*not felt at all*) to 7 (*very strongly felt*).

2.2.2 Physiological measure

Heart rate variability (Study III) was monitored using the LRR-03 (GMS Co., Ltd, Tokyo, Japan). This device performs frequency analyses of the electrocardiogram waveform externally inputted from three electrodes attached to the left upper chest, the left abdomen, and the right abdomen. From the obtained data, HR, HF, and LF/HF were estimated using TARAWA (GMS Co., Ltd, Tokyo, Japan), which performs real-time power spectral analysis with the maximum entropy method.

Salivary alpha-amylase (sAA; Study IV) was collected and measured by the participants themselves. They were instructed to collect saliva samples with a filter paper and to measure the concentration of sAA with a portable salivary amylase monitor (Nipro Co. Ltd., Japan). These methods were based on the manual provided by the manufacturer Nipro Co. Ltd., Japan.

2.2.3 Background variable

In this research, several personal and occupational variables were controlled for. In Study I, age, gender (male/female), educational background, employment type (permanent/contract/part-time/other), and shift type (regular daytime/irregular daytime/regular night/irregular daytime and night) were processed as covariates. In Study II, age, gender (male/female), and employment type (permanent/contract/part-time/other) were adjusted for because they had a significant effect on the outcome variables. In Study IV, gender (male/female), BMI, and shift type (regular daytime/irregular daytime/regular night/irregular daytime and night) were processed as covariates due to their significant impacts on the diurnal sAA levels.

2.2.4 Data analyses

In Study I, a latent profile analysis (LPA) was carried out to identify the profiles of trait EI by using Mplus version 6 (Muthén & Muthén, 2010). The differences between the trait EI profiles in the outcome variables were tested with multivariate analysis of covariance (MANCOVA) on SPSS 21.0.

In Study II, confirmatory factor analyses were conducted using AMOS 21.0 to examine the discriminant validity of the study variables. The hypothesized multiple mediation, moderation, and moderated mediation models were tested with model 6, model 1, and model 7 of PROCESS macro (Hayes, 2013), respectively. For the moderation and mediated moderation models, the levels of the moderator (trait EI) were defined as high trait EI (standardized variable +1 *SD*), moderate trait EI (standardized variable 0), and low trait EI (standardized variable -1 *SD*) by using the pick-a-point method (Hayes, 2013).

In Study III, we first mean-split the score of the WLEIS obtained from 446 participants in the preliminary questionnaire-based field survey conducted in May 2012 to form a high trait EI group and low trait EI group. We then randomly chose 15 participants from each group and invited them to participate in the present experimental study. Second, one-way repeated measures of ANOVA and paired *t*-tests were used to check the effectiveness of stress manipulation on psychological stress (mood and perceived stress). Third, the difference between the two trait EI groups in psychological stress was examined by the Mann-Whitney *U*-test. Fourth, we used two-way repeated measures of ANOVA to test the difference between the groups of trait EI in HRV (HR, HF, and LF/HF). Finally, a multiple regression analysis with the backward elimination method was performed to investigate the effect of the different components of trait EI on HF in each period of the experiment.

In Study IV, the sample was categorized into a high trait EI group and a low trait EI group according to the mean score of the EQS. We performed two-way repeated measures of ANOVA to investigate the differences between the trait EI groups in variation in daily affect (positive affect and negative affect). For the sAA analyses, since the distribution of the sAA values were positively skewed, they were transformed by the Box-Cox power transformation (Box & Cox, 1982; Sakia, 1992). Based on the estimates, the area under the curve with respect to ground (AUCg) was estimated using the trapezoid formulas (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003). A two-way repeated measure of ANOVA was then performed to examine the difference between the trait EI groups in their diurnal sAA levels. All analyses in Study III and Study IV were conducted using SPSS 21.0.

The data analytical methods presented here are described in more detail in each original publication.

3 OVERVIEW OF THE ORIGINAL PUBLICATIONS

3.1 Study I: A latent profile analysis of trait emotional intelligence to identify beneficial and risk profiles in well-being and job performance: A study among Japanese eldercare nurses

This study aimed, first, to identify latent profiles of trait EI by using the person-centered approach, and second, to examine the association of the trait EI profiles found with SWB (work engagement, burnout, depression) and job performance. The participants in this study were 500 Japanese human care workers (eldercare nurses) from 28 intensive care homes for the elderly. Finally, the samples obtained from 461 participants (female: $n = 377$ [81.8%]; male: $n = 84$ [18.2%], mean age = 38.9 years, $SD = 11.0$) were used for the statistical analyses.

In support of H1, the latent profile analysis identified six distinct profiles of trait EI: (1) *An extremely high profile*, characterized by the highest scores on all three dimensions of trait EI, including relatively low interpersonal compared to intrapersonal and situational EI ($n = 16$ [3.4%]); (2) *A high profile*, characterized by high scores on all three components of trait EI ($n = 70$ [15.2%]); (3) *A moderate profile*, with moderate scores on all three components of trait EI ($n = 154$ [33.4%]); (4) *A disproportional profile*, characterized by a combination of moderate intrapersonal EI, high interpersonal EI, and very low situational EI ($n = 53$ [11.5%]); (5) *A low profile*, with low scores on all three components of trait EI ($n = 109$ [23.6%]); and (6) *An extremely low profile* characterized by the lowest scores on all three components of trait EI ($n = 59$ [12.8%]).

A MANCOVA revealed, in support of H2, that the profiles with higher scores on all the trait EI components were associated with lower burnout, lower depression, higher work engagement, and higher job performance. In contrast, the profiles with lower scores on all three trait EI components were associated with relatively negative outcomes, thereby supporting (H4). In addition, the result showed that the extremely high profile was associated with higher SWB and the highest job performance, while the disproportional profile was associ-

ated with higher depression, lower job performance, and moderate work engagement. Consequently, H3 and H5 were partially supported.

To summarize, these results suggest that trait EI may be related to SWB, as well as performance, depending not only on the global level but also the pattern of the dimensions (i.e., the proportion of each ability dimension). In general, a higher global score on trait EI is related to better SWB and higher job performance, whereas a lower global score on trait EI is linked to lower SWB and poorer job performance. Moreover, the extremely high profile may be the best pattern of the trait EI components for SWB and job performance, and the disproportional profile may be a risk form of trait EI.

3.2 Study II: Associations of trait emotional intelligence with social support, work engagement, and creativity in Japanese eldercare nurses

Study II focused on the role of trait EI in the process of SWB. Specifically, the purpose of this study was to investigate the linear and interactive contribution of trait EI to the process through which social support positively affects work engagement, which further predicts employee creativity. The participants in this study were the same as those used in Study I. Of the original participants ($N = 500$), data collected from 489 (female: $n = 401$ [82.0%]; male: $n = 88$ [18.0%], mean age = 39.5 years, $SD = 11.0$) were eligible for the statistical analyses.

Preliminary analyses conducted with confirmatory factor analysis revealed that the four-factor model showed the best model fit compared to the three alternative models ($\chi^2 = 166.05$ [$df = 48$], $CN = 217$, $GFI = 0.95$, $CFI = 0.96$, $RMSEA = 0.07$, $AIC = 226.05$), suggesting the discriminant validity of the study constructs (trait EI, social support, work engagement, and creativity).

A multiple mediation analysis yielded four main results: First, in accordance with our expectation (H6), trait EI directly positively predicted the other study variables. Second, social support showed a direct, positive effect on work engagement, but not on creativity, thereby partially supporting H7. Third, trait EI positively predicted creativity by mediating work engagement ($\beta = 0.06$, 95% CI [0.028, 0.111]), an observation supporting H8. Fourth, trait EI had a positive impact on creativity through social support and work engagement sequentially ($\beta = 0.01$, 95% CI [0.003, 0.015]). The overall model accounted for 19 % of the total variance of creativity ($F(6, 482) = 16.81$, $p = .000$).

A moderation analysis showed, in support of H9, that trait EI moderated the relationship between social support and work engagement ($\beta = 0.07$, 95% CI [0.004, 0.143]): when trait EI was at a high level, social support significantly and positively predicted work engagement ($\beta = 0.24$, 95% CI [0.138, 0.345]). In addition, the positive effect of social support on work engagement was also significant when trait EI was at a moderate level ($\beta = 0.17$, 95% CI [0.087, 0.249]). However, in cases where trait EI was at a low level, the link between social

support and work engagement was non-significant ($\beta = 0.09$, 95% CI [-0.021, 0.210]).

A moderated mediation analysis revealed that the moderating effect of trait EI on the social support-work engagement relationship extended to creativity (index of moderated mediation: $\beta = 0.02$, 95% CI [0.003, 0.047]). The results showed that when trait EI was at the moderate or higher levels, social support positively predicted creativity via work engagement (moderate trait EI: $\beta = 0.05$, 95% CI [0.027, 0.080]; high trait EI: $\beta = 0.07$, 95% CI [0.042, 0.108]). However, in cases where trait EI was at a low level ($\beta = 0.02$, 95% CI [-0.005, 0.067]) this indirect effect of social support on creativity was non-significant. The overall moderated mediation model was a full mediation model, showing the null direct effect of social support on creativity ($\beta = 0.03$, $p = .501$, 95% CI [-0.059, 0.120]). Hence, these findings supported H10.

In sum, the present research yielded four main findings for trait EI. First, trait EI directly improves social support, work engagement, and creativity. Second, trait EI promotes creativity by enhancing work engagement. Third, trait EI improves work engagement by enhancing social support, which further improves creativity. Fourth, satisfactory (moderate or higher) levels of trait EI enhance the positive effect of social support on work engagement, which ultimately stimulates employee creativity. However, when trait EI is insufficiently cultivated, social support may not act as a promoter of work engagement and thus also creativity. Overall, these findings indicate that trait EI can positively contribute to the process through which social support promotes work engagement and creativity sequentially in a linear and interactive fashion.

3.3 Study III: The effect of trait emotional intelligence on psychophysiological stress response induced by mental stress testing

Study III investigated how trait EI is related to psychological (mood and perceived stress) and physiological (HRV) responses to acute stress induction. First, based on the field-experimental study paradigm, a questionnaire-based field survey, including the Japanese version of the WLEIS (a self-report measure of EI), was conducted among Japanese undergraduate students ($N = 446$) in May 2012. Second, we classified the participants into a high trait EI group and a low trait EI group using the mean of the WLEIS. Third, 15 healthy participants were randomly chosen from each group and invited to the experimental study. Finally, except for two individuals in the high group who declined to participate, a total of 28 students (high trait EI group: $n = 13$ [male: $n = 7$, female: $n = 6$], age = 21.4 years, $SD = 6.2$; low trait EI group: $n = 15$ [male: $n = 9$, female: $n = 6$], age = 20.7 years, $SD = 4.5$) underwent the laboratory-based stress experiment.

The stress experiment was implemented in accordance with the protocol established by Yajima (2012). The experiment was composed of three main

phases: an anticipation phase lasting 10 min, a task phase lasting 10 min, and a recovery phase of 30 min. For the stress manipulation objective, we administered a public speech task (5 min) and a mental arithmetic task (5 min). Mood (energy arousal, tense arousal) and psychological stress (task engagement, distress, and worry) were assessed immediately after each phase and just before and immediately after the task phase. HRV was continuously measured throughout the experiment in a non-invasive manner. For the estimates of trait EI, the participants' scores on the WLEIS obtained in the field survey implemented in May 2012 were used.

The results of the stress manipulation experiment showed that the participants experienced an upsurge in psychological stress. A nonparametric test (the Mann-Whitney *U*-test) revealed that the individuals scoring higher on trait EI showed better mood (higher energy arousal, lower tense arousal) in the anticipation phase and the recovery phase than those scoring lower on trait EI. In addition, these individuals exhibited higher task engagement before and during the task phase and lower distress in the anticipation phase than their lower trait EI peers. However, the level of psychological stress (tense arousal, distress, and worry) during the stress phase was the same in both the individuals with higher trait EI and those with lower trait EI.

On the participants' physiological reaction, two-way repeated measures of ANOVAs revealed a significant interaction effect, exclusively on HF, between trait EI and time ($F(4, 104) = 4.36, p < .05, \eta_p^2 = .144$). The individuals scoring higher on trait EI showed higher HF in the anticipation phase ($p < .01$) than their lower trait EI counterparts. However, contrary to H11, HF in individuals with higher trait EI was suppressed during the stress loading to the same extent as it was in those with lower trait EI. Despite the high-stress response, the individuals with higher trait EI exhibited significantly higher HF in the recovery phase ($p < .01$), an observation which supports H12. Moreover, these individuals displayed more flexible variation in HF throughout the experiment: HF significantly decreased in response to the stress tasks ($p < .01$ [vs. the anticipation phase]), after which it bounced back to the baseline level during the recovery phase (15 min after the stress loading: $p < .01$ [vs. the task phase]). In contrast, HF in individuals scoring lower on trait EI showed relatively little variation: by carrying over the marked reduction at the baseline level, HF showed a non-significant decrease in response to the stress induction tasks, and this lowered level of HF had barely returned to the baseline level 30 min after coping with the stress stimulus.

Additional analyses revealed that emotion regulation was the component of trait EI which most strongly and positively predicted HF in the anticipation phase ($\beta = 0.37$) and the recovery phase (15 min after the stress session: $\beta = 0.45$, 30 min after the stress session: $\beta = 0.37$).

Overall, these results suggest that higher trait EI may serve to down-regulate psychophysiological stress in anticipation of a stress event and promote faster and better psychophysiological recovery following stress, although it may also contribute to high reactivity to the stressor. By contrast, lower trait

EI may be linked to higher psychophysiological stress in the face of acute stressors.

3.4 Study IV: Trait emotional intelligence, self-reported affect, and salivary alpha-amylase on working days and a non-working day

Study IV investigated the association of trait EI with self-reported affect (positive affect, negative affect) and physiological well-being (sAA) in the cycle of stress (working day) and recovery (non-working day) in day-to-day life. This study was carried out in a naturalistic situation over three successive days: working day 1, a non-working day, and working day 2. The participants were randomly selected from the Japanese eldercare nurses working in intensive care homes for the elderly who participated in our previous research conducted in April 2014 (Study I and Study II).

Participants were instructed to sample their saliva and measured the concentration of sAA at 08:30, 12:00, and 18:00 on the study days. They also filled in a questionnaire on day-level affect after finishing their work on each day. For trait EI, we retrospectively utilized the EQS data the participants had provided in our earlier research (Studies I and II). A total of 45 of the 50 randomly selected individuals completed all the tasks. After eliminating five samples due to either their extreme sAA values (± 3 *SD* from the mean; $n = 2$) or deviation from the schedule prescribed for the saliva sampling ($n = 3$), the statistical analyses were performed on the data of 40 participants (female: $n = 32$, male: $n = 8$, age = 33.7 years, *SD* = 10.9). Prior to the statistical analyses, the scores for trait EI (the EQS) were mean-split into high and low, thereby forming two trait EI groups (a high trait EI group: $n = 21$, age = 32.5 years, *SD* = 10.9; and a low trait EI group: $n = 19$, age = 35.1 years, *SD* = 11.3).

Two-way repeated ANOVAs revealed a main effect of day on both positive affect ($F(2, 61) = 7.95, p = .002, \eta_p^2 = .173$) and negative affect ($F(2, 76) = 6.52, p = .002, \eta_p^2 = .146$). Positive affect tended to increase from working day 1 to the non-working day ($p = .087$), after which it returned to the baseline level on working day 2. Negative affect was the highest on working day 1, showing a significant reduction both on the non-working day ($p = .005$) and on working day 2 ($p = .043$). These day-to-day variations in affect indicate that affective recovery occurred over the study days. The results also revealed that trait EI had a main effect on positive affect ($F(1, 38) = 10.35, p = .003, \eta_p^2 = .214$). The individuals with higher scores on trait EI showed higher PA across the days with than those with lower trait EI scores. However, we detected neither a main effect of trait EI nor an interaction effect between EI and day on negative affect. Therefore, the results partially supported H13.

One-way repeated ANOVA showed a non-significant main effect of time on sAA on working day 1 ($F(2, 78) = 2.29, p = .108, \eta_p^2 = .055$) and on working

day 2 ($F(2, 78) = 0.14, p = .870, \eta_p^2 = .004$), and a significant main effect during the non-working day ($F(2, 60) = 4.99, p = .016, \eta_p^2 = .114$). In addition, the day-to-day variation in diurnal sAA was also non-significant ($F(2, 78) = 2.10, p = .129, \eta_p^2 = .051$). These results suggest that the variation in sAA was stable both across the respective day and across the three study days. Two-way repeated ANOVA showed no significant difference between the individuals with higher trait EI and those with lower trait EI in the between-days variation in diurnal sAA ($F(2, 70) = 0.49, p = .616, \eta_p^2 = .014$). Nevertheless, the analysis revealed that trait EI had a significant main effect on sAA ($F(1, 35) = 5.75, p = .022, \eta_p^2 = .141$): Diurnal sAA on the non-working day ($p = .021$) and working day 2 ($p = .053$) were lower in the individuals with higher trait EI than in those with lower trait EI. Therefore, the results partially supported H14.

To summarize, these results suggest that higher trait EI may be related to a greater sense of affective well-being and lower sympathetic activity in the cycle of stress (working day) and recovery (non-working day) in a naturalistic situation.

TABLE 3 A summary of the results concerning hypotheses in the present research

No.	Hypotheses	Supported
H1	Since trait EI is composed of various distinct emotional abilities, latent profile analysis will reveal different trait EI profiles.	Yes
H2	Trait EI profiles with a higher overall trait EI dimension will be associated with better subjective well-being and higher job performance.	Yes
H3	Trait EI profiles with lower interpersonal EI compared with the other EI dimensions within the profile will also be associated with better outcomes.	Partially
H4	Trait EI profiles with lower overall trait EI dimension scores will be associated with poorer well-being and lower job performance.	Yes
H5	Trait EI profiles with higher interpersonal EI compared with other EI dimensions within the profile will also be associated with poorer outcomes.	Partially
H6	Trait EI shows a positive, direct relationship with social support, WE, and creativity.	Yes
H7	Social support shows a positive, direct relationship with WE and creativity.	Partially
H8	Trait EI is positively associated with creativity via WE.	Yes
H9	Trait EI moderates the relationship between social support and WE. WE is higher when both trait EI and social support are high.	Yes
H10	A conditional effect of social support on creativity is mediated by WE. In this relationship, creativity is stronger when trait EI is high.	Yes
H11	Individuals scoring higher on trait EI will show a lower level of autonomic (HRV) response to laboratory-based acute stress induction than those scoring lower on trait EI.	No
H12	Individuals scoring higher on trait EI will display better autonomic (HRV) recovery following stress than those scoring lower on trait EI.	Yes
H13	Individuals with higher trait EI will show higher positive affect and lower negative affect than individuals with lower trait EI.	Partially
H14	Individuals with higher trait EI will show a lower level of diurnal sAA than individuals with lower trait EI.	Partially

Note. EI = emotional intelligence; WE = work engagement; HRV = heart rate variability; sAA = salivary alpha-amylase.

4 GENERAL DISCUSSION

The primary purpose of the present thesis was to investigate the association between trait EI and well-being at the psychological (SWB) and the physiological (physiological well-being) level among Japanese participants. Specifically, this research had four primary purposes: First, to identify the profile of trait EI and to examine the relationship between the trait EI profiles and SWB (work engagement, burnout, depression); second, to investigate the role of trait EI in the process of SWB (from social support through work engagement to creativity); third, to examine the link of trait EI to psychological stress (mood, perceived stress) and physiological (HRV) responses in a laboratory-based stress induction experiment; and fourth, to investigate the connection between trait EI and self-reported affect (positive affect, negative affect) and trait EI and physiological well-being (sAA) in a cycle of stress and recovery in day-to-day life.

The present research yielded three major findings. First, in addition to the global levels of trait EI, the configuration of the scores on the three dimensions of trait EI affected SWB: the trait EI profiles with higher scores in all three dimensions were associated with better SWB, whereas the trait EI profiles with lower scores in all three dimensions were related to poorer outcomes. In addition, the extremely high profile (the highest scores in all dimensions, although a relatively lower score in interpersonal EI) and the disproportional profile (a combination of moderate intrapersonal EI, high interpersonal EI, and markedly low situational EI) may be associated with best and with negative consequences, respectively. Second, trait EI was also linked to better physiological well-being, both in the induced stress condition and in the process of recovery in a naturalistic situation. Third, trait EI positively contributed to the process of SWB in a linear and interactive fashion: Trait EI enhanced the perception of social support, and the act of social support improved SWB (work engagement) and in turn creativity. Further, trait EI interacted with social support to predict work engagement and subsequent creativity, a sufficient (moderate or higher) level of trait EI allowing social support to promote work engagement and creativity sequentially.

In the following sections, these main findings are discussed in more detail.

4.1 The nexus between the profiles of trait EI and SWB

To date, EI has been conceptualized as a multi-dimensional construct that includes various emotional abilities, skills, and competencies (Bar-On, 1997; Mayer & Salovey, 1997; Petrides, 2009; Shutte et al., 1998). This implies that individuals may also be differentiated in the pattern (proportion) of their scores on the three dimensions of global trait EI that they display. The present research used the person-centered approach to investigate this possibility and further examined the association between the different trait EI profiles distinguished and SWB.

Latent profile analysis identified six distinct profiles of trait EI: an extremely high profile; a high profile; a moderate profile; a disproportional profile; a low profile; and an extremely low profile. Due to the strong inter-correlation between the dimensions ($r = .72$ to $.78$ [estimated retrospectively]), most profiles categorizable from the comprehensive bivariate perspective (i.e., high global trait EI vs. low global trait EI). In general, the results showed that profiles with higher scores on global (all three dimensions of) trait EI were associated with lower burnout, lower depression, and higher work engagement, whereas the profiles with lower scores on global trait EI were linked to more negative outcomes. These findings lend support to the theoretical prediction that higher EI leads to a positive psychological state, and that lower EI predisposes to emotional distress (Mayer et al., 2008; Salovey et al., 1999; Salovey & Mayer, 1990; Zeidner et al., 2012). It is also consistent with prior empirical studies indicating that trait EI is positively associated with an energetic state of mind in work (e.g., Akhtar et al., 2015; Garrosa et al., 2011; Schutte & Loi, 2014; Zhu, Liu, Guo, Zhao, & Lou, 2015), but negatively with chronic job stress and psychological impairment (e.g., Görgens-Ekermans & Brand, 2012; Lee & Ok, 2012; Mikolajczak, Menil, et al., 2007; Zysberg et al., 2016). Individuals with a higher emotional capacity are more likely to achieve a greater sense of socio-emotional well-being. By contrast, individuals with poorer emotional capacities are more likely to be tormented by emotional distress.

More interesting results were observed for two profiles of trait EI each showing a marked difference in the level of one dimension: the extremely high profile (the highest scores on all dimensions, with relatively lower interpersonal EI than intrapersonal EI and situational EI) and the disproportional profile (a combination of moderate intrapersonal EI, high interpersonal EI, and markedly low situational EI). The extremely high profile was associated with better psychological state (lower burnout, lower depression, and higher work engagement) than the other profiles, except for the high profile (higher scores on all components of trait EI). In addition, the extremely high profile was associated with the highest job performance. Consequently, the profile displayed the best outcomes of all the identified profiles. While the primary focus of the present research is on SWB *per se*, the latter result may also be important when considering the possibility that job performance is reciprocally related to SWB (Judge,

Thoresen, Bono, & Patton, 2001). Assuming that this relationship holds, this profile might, in the long run, be the most favorable profile of trait EI for SWB. However, it should be recalled that this profile was identified for a small minority in the present sample ($n = 16$ [3.4%]), indicating the possibility that it was sample-specific. Thus, the reproducibility of this profile needs to be confirmed in other (non-Japanese) samples.

The disproportional profile was associated with relatively negative outcomes such as higher depression and lower job performance, despite the link to moderate work engagement. This profile accounted for 11.5% of the total sample. A similar vulnerable profile was found in an earlier taxonomic EI study in a sample of hospital nurses (Gerits et al., 2005), implying that this profile might be consistently present among human care professionals. By comparing to the moderate profile, the negative consequences of this profile may be due to the strength of interpersonal EI and the striking weakness of situational EI. Although interpersonal ability is considered a foundation skill for nursing practice (McQueen, 2004), excellence in this ability may not always be good for nurses' well-being in view of the risk for empathetic distress (Gerits et al., 2005; Picard et al., 2016). Higher levels of empathy, a core constituent of interpersonal EI (Uchiyama et al., 2001), has shown an association with adverse psychological outcomes in nurses, such as increased burnout (Williams, 1989), higher depression (Schieman & Turner, 2001), and lowered life satisfaction (Lee, Brennan, & Daly, 2001). In addition, poor situational emotional capacity may also be harmful, considering that nurses often encounter emotionally demanding situations in everyday work (e.g., Augusto-Landa, López-Zafra, Berrios-Martos, & Aguilar-Luzón, 2008). Empirical evidence showing the vital importance of situational EI for affective well-being (Kitahara & Bohgaki, 2012), and for the quality of care performance (Fujino et al., 2015) has been found among Japanese nurses.

Overall, these findings support earlier typological studies on trait EI (e.g., Gerits et al., 2005; Keefer et al., 2012), which have suggested that not only the global level but also the pattern of the scores on the constituents of global trait EI is involved in determining the consequences of human well-being and performance. Since the essence of trait EI is a multi-faceted personal characteristic, it is highly possible that beneficial and non-beneficial profiles of the construct exist in specific contexts (Petrides, 2011). The present findings suggest that for SWB in the context of eldercare nursing, the extremely high profile may be the most beneficial pattern of trait EI for SWB, and the disproportional profile may be a risk configuration of trait EI for SWB.

4.2 Associations of trait EI with physiological well-being

The physiological effect of trait EI has received limited attention thus far. Only a handful physiological research exists on trait EI, leaving a gap in our understanding of, in particular, the association between trait EI and the ANS. The

present dissertation addressed this issue in two studies, in an experimental study (Study III) and a field study (Study IV).

In the experimental study (Study III), a significant interaction effect of trait EI and time was observed only on HF, an indicator of parasympathetic activity. This observation contradicts the results of a laboratory-based stress experiment by Laborde et al. (2011) which found a specific association of trait EI with LF/HF, a biomarker of the balance between sympathetic and parasympathetic activities. This discrepancy could be due to the difference between the studies in the method of stress manipulation. The present study utilized a public speech task and a mental arithmetic task, whereas Laborde et al. (2011) used a combination of negative imagery script, sound of a crowd noise, and sentences which instigate competition and anxiety (e.g., "Your opponents don't lack anything", "Motivation is leaving you"). These stressors differ in their essence. The former stressors may require active coping, while the latter stressors may lead to passive coping (Obrist et al., 1978). It has been suggested that heterogeneous stressors can elicit different cardiovascular reactions (e.g., Obrist, 1981; Obrist et al., 1978).

The results further revealed that individuals scoring higher on trait EI showed higher arousal of positive mood, less emotional distress, and higher HF before the stress induction (i.e., the anticipation phase) than those scoring lower on trait EI. These results accord with those of earlier experimental studies using stress tasks that found individuals with higher trait EI to display more positive mood (Salovey et al., 1995; Schutte et al., 2002), greater state self-efficacy (Schutte et al., 2002), and lower cortisol secretion (Mikolajczak, Roy, et al., 2007; Salovey et al., 2002) at the baseline phase (before the stress tasks). It seems that people high in trait EI are less likely than those low in trait EI to experience distress and more likely to achieve a positive psychosomatic state in a situation that is potentially uncomfortable and demanding due to the anticipation of stress. A possible reason for this could be that they perceive the anticipatory situation in a more positive manner. Persons with higher trait EI are likely to appraise stress event as a challenge rather than a menace (Mikolajczak & Luminet, 2008; see also Salovey et al., 2002). Challenged persons tend to outperform threatened individuals in showing positive mood and achieving an adaptive physiological response in adversity (Dienstbier, 1989; Schneider, Lyons, & Khazon, 2013).

Contrary to expectation, however, higher trait EI did not serve as a buffer against stress response during the stress induction condition. More specifically, individuals with higher trait EI showed as high a level of emotional distress and a reduced level of parasympathetic activity during the stress session as their lower trait EI peers. Moreover, they showed higher parasympathetic reactivity to the stress stimulus. These results are in line with earlier studies which found a marked stress reaction to factitious mood induction in persons scoring higher on trait EI (e.g., Arora et al., 2011; Ciarrochi, Chan, & Caputi, 2000; Fernández-Berrocal & Extremera, 2006; Goldman, Kraemer, & Salovey, 1996; Petrides & Furnham, 2003; Salovey et al., 1995; Sevdalis, Petrides, & Harvey, 2007), sup-

porting the theoretical view that high trait EI is not advantageous in all circumstances (Petrides, 2011; Petrides & Furnham, 2003). The reason for these results could be partially related to high capacity to attend to emotions experienced by the self (e.g., Goldman et al., 1996; Petrides & Furnham, 2003). For example, Petrides and Furnham (2003) found that persons with higher trait EI showed greater mood deterioration in response to negative mood inductions than their lower trait EI counterparts. They attributed this to the greater sensitivity to emotional experiences inherent in high-trait EI people. Since excessive self-focus on negative mood induces cognitive bias (Mor & Winquist, 2002; Ruiz-Robledillo & Moya-Albiol, 2014), this emotional ability may act to intensify the high-trait EI individual's psychosomatic response to an acute stressor (Goldman et al., 1996; Petrides & Furnham, 2003).

Nevertheless, individuals scoring higher on trait EI displayed better psychological state and higher parasympathetic activity after the stress exposure condition (especially at 15 min after stress loading) than those scoring lower on trait EI. That is, these results suggest that despite the prominent stress reaction to the mental tasks, persons high in trait EI recovered faster and better from the stress experience. This finding harmonizes with earlier studies showing implementation of efficient emotion regulation after mood manipulation (Ciarrochi et al., 2000; Petrides & Furnham, 2003; Schutte et al., 2002) and better affective restoration following stress stimulus (Arora et al., 2011; Sevdalis et al., 2007) in individuals scoring higher on trait EI. In addition, the present finding supports Tugade and Fredrickson (2002), who describe emotionally intelligent individuals as *resilient people* (see also Salovey et al., 1999). In the face of a stress event, persons with superior ability to process emotions and emotion-laden information are more likely to draw on and harness positive emotions to mitigate negative emotional experiences, thereby achieving better psychosomatic recuperation (Tugade & Fredrickson, 2002). Considering the crucial significance of recovery capacity for successful adaptation to stress (Dienstbier, 1989; Linden, Earle, Gerin, & Christenfeld, 1997; McEwen, 2000), higher trait EI seems to be linked to more accommodative profile of autonomic response in the acute stress situation.

In the field study (Study IV), I also observed the physiological benefit of trait EI. Specifically, the results of this study showed that individuals scoring higher on trait EI showed a lower level of diurnal sAA on a day off (a non-working day) than those scoring lower on trait EI, and the between-individual difference continued to show a tendency to significance on the subsequent weekday (the next working day). In addition, individuals with higher trait EI also showed higher positive affect across the study days than their lower trait-EI peers, although they did not differ in the level of negative affect. Altogether, the present results suggest that persons high in trait EI are likely to maintain better affective well-being and present lower sympathetic activation in the process of recovery in the naturalistic situation compared to those low in trait EI. It is noteworthy that trait EI also had a physiological effect in the more neutral condition, supporting Zeidner et al. (2012), who assert that trait EI operates up-

on the processing of emotion-laden phenomena occurring not only in adversity but also in various other situations in everyday life. Consequently, these findings support the theoretical prediction that higher trait EI leads to effective management of emotions (Mayer & Salovey, 1997; Mayer et al., 2008; Petrides et al., 2016; Salovey & Mayer, 1990; Zeidner et al., 2012).

Regarding the cause of the potential physiological effect of trait EI, despite the lack of any direct result, the observation that higher trait EI was associated with a greater sense of positive affect prompts the speculation that it may be attributed to the adaptive potential of positive emotions. As described by the broaden-and-build theory (Fredrickson, 1998, 2001, 2013), the experience of positive emotions, extending the array of mindsets and actions, promotes the establishment of enduring personal resources, contributing to resiliency and well-being. Moreover, research has suggested that positive emotions act as a direct sedative for sympathetic distress (Fredrickson, 1998, 2001, 2013; Fredrickson, Mancuso, Branigan, & Tugade, 2000). For instance, Doane and Van Lenten (2014) found that high trait positive emotions predicted lower diurnal sAA production in a naturalistic situation. Likewise, Steptoe et al. (2005) found that positive affect, generated from momentary experiences of happiness, was inversely associated with heart rate over a leisure day. Finally, Tugade and Fredrickson (2004) revealed better cardiovascular recovery following a negative mood experience in individuals with positive emotionality. Thus, future research could investigate whether positive emotions function as a mediating mechanism linking trait EI to sympathetic activity in the cycle of stress and recovery in daily life.

Taken together, the present research demonstrates a significant association between trait EI and the ANS. The overall results suggest that individuals with higher trait EI may manage the ANS activity, both in the face of acute stress and in the process of recovery, more effectively in the naturalistic situation compared to those with lower trait EI. Although the current research was merely a short-term investigation, the fact that trait EI is a relatively solid construct over time (e.g., Costa & Faria, 2016; Uchiyama et al., 2001) has implications for health. Presumably, high-trait EI people are likely to achieve better health because their excellent capacity for recovery contributes to sustaining the healthy functioning of the physiological stress systems (Dienstbier, 1989; McEwen, 2000). In contrast, low-trait EI people might be more susceptible to health impairment, as having little resiliency contributes to the accumulation of damage to the internal stress mechanisms (McEwen, 2000; Rozanski & Kubzansky, 2005).

4.3 Trait EI as a personal resource for the process of SWB

The present thesis further attempted to investigate the role of trait EI in the process through which social support affects work engagement and subsequent creativity at work, and hence contributes to SWB. The results showed that trait EI had a direct positive effect on social support. This finding indicates that indi-

viduals with higher emotional capacity are likely to have a greater sense of social support, which is consistent with several studies linking trait EI to social skills and competencies (Kong et al., 2012a, 2012b; Schutte & Loi, 2014). It is also in line with the theory that trait EI enriches supportive social connections (Salovey et al., 1999; Zeidner et al., 2012). This function of trait EI may be rooted in its ability to facilitate self-knowledge, including self-concept, self-esteem, and personal identity (Augusto-Landa & López-Zafra, 2010; Mahon et al., 2014). By promoting awareness of one's needs of others' assistance, higher trait EI may promote the propensity to seek supportive sources and encourage the pursuit of better social capital, leading to greater perception of and satisfaction with the social support received (Kong et al., 2012a, 2012b; Mahon et al., 2014; Schutte & Loi, 2014).

The result also showed that trait EI improved work engagement by enhancing social support. The act of work engagement further fostered employee creativity. The overall model was the partial mediation model, with trait EI also directly promoting creativity. The positive pathway from trait EI through social support to work engagement is congruent with findings of Schutte and Loi (2014), thereby underscoring their assertion that trait EI may be a foundation for nourishing the social resources which promote workplace flourishing. The finding is also in accordance with the theoretical description on the interpersonal mechanism through which higher trait EI elicits a greater sense of well-being by improving social skills, relationships, and engagement (Salovey et al., 1999; Zeidner et al., 2012). It is plausible that social support is a key psychosocial mediator of affective benefits of trait EI on SWB.

The mechanism underlying this pathway may be also explained by the COR theory (Hobfoll & Shirom, 2001), positing that people strive to invest personal resources to prevent resource loss and gain additional resources. High-trait EI individuals better cope with emotional distress and build up more positive, supportive social relationships (Akhtar et al., 2015; Salovey et al., 1999; Zeidner et al., 2012). These superior capabilities expedite the accumulation of social resources, which encourages these individuals to make energetic efforts to accomplish work objectives (Akhtar et al., 2015). Insight into the motivational role of social resources may be gained from the social exchange theory (Cropanzano & Mitchell, 2005), which holds that sound social transaction with others contributes to effective work-related behaviors and positive employee attitudes. In return for acquiring useful resources in a good social alliance, people are more likely to expend effort and energy on work tasks (Saks, 2006).

Regarding the overall positive pathway, including creativity (i.e., from trait EI through social support and work engagement to creativity), the present result extends that reported by Carmeli, McKay, and Kaufman (2014), who found that trait EI promoted employee creativity by enhancing prosocial behavior (generosity) and vigor. The present result suggested that another type of psychosocial factor, i.e., social support, and a broader conception of positive state of mind at work, i.e., work engagement, also functions as a mediating mechanism of trait EI and creativity. It appears that people who have a higher

emotional capacity and use it to build cooperative social relationships may be more likely to express higher engagement in their work, initiating creative efforts. This finding supports the premise of the broaden-and-built theory that the experience of positive emotions enlarges the repertoire of possible thoughts and actions, which, in turn, fosters the pursuit of novelty and creativity (Fredrickson, 1998, 2001; see also Isen, 1990; Parke, Seo, & Sherf, 2015).

The results further revealed that trait EI interacts with social support in the prediction of work engagement, and hence creativity. Trait EI amplified the positive linkage between social support and work engagement (the moderation model), and the indirect effect of trait EI was extended to employee creativity (the moderated mediation model). The results showed that when trait EI was at a moderate or higher level, social support boosted creativity by enlivening work engagement. However, in cases where trait EI was at the low level, this relationship no longer held. Furthermore, the moderated mediation model was a full mediation model, displaying the null direct impact of social support on creativity. Taken together, these results suggest that trait EI may play a decisive role in this relationship: unless emotional capacity is sufficiently cultivated, people may find it difficult to mobilize social support to empower work engagement, and the subsequent deployment of creativity at work. This finding adds to the argument of Williams et al. (2009) that trait EI may serve as a driving force for the potential of job resources to promote positive employee outcomes.

In sum, the results suggest that trait EI makes a positive contribution to the process of SWB in a linear and interactive fashion. Trait EI improves employee engagement via enhancing the perception of social support, which ultimately fosters employee creativity. Moreover, trait EI interacts with social support to predict work engagement, and subsequent creativity, with only moderate or higher levels of trait EI enabling social support to stimulate work engagement and creativity sequentially. These findings suggest that the interpersonal process through which trait EI improves work engagement, and hence creativity, by augmenting the perception of social support may only operate in cases where individuals cultivate a sufficient level of emotional capacity.

4.4 Strengths and limitations

The present research has several theoretical and methodological strengths. First, it is stated at the outset that of the two primary constructs (i.e., ability EI and trait EI) that are treated in the literature, trait EI is the theoretical construct of interest in this study. This has not always been made clear in studies of EI conducted in Japan. Accordingly, the present results can reasonably be explained in terms of the traditional theories or models of personality and differential psychology (Petrides, 2010, 2011).

Second, the vast majority of prior studies on EI have mainly addressed the psychological effects of the construct. In Japan, especially, the research focus

has been exclusively on the affective outcomes of trait EI. In this study, in turn, an important aim was to investigate well-being also at the physiological level. The results suggest that trait EI may promote healthy physiological activity. Moreover, such a positive effect of trait EI was observed in the stressful condition (stress experiment) as well as in the naturalistic situational condition (field survey). Overall, the present findings demonstrate that the benefits of trait EI for well-being have ecological validity.

Third, in the literature, although trait EI has been described as a multi-dimensional construct, most studies have relied on the variable-centered approach as an analytical strategy. To address this limitation, the present research used a person-centered approach, which makes it possible to group people according to their similarity in different combinations of the study variables (Laursen & Hoff, 2006). Applying the approach yielded six distinct profiles of trait EI. The subsequent analysis then revealed differences between these trait EI profiles in the well-being indicators. Consequently, the present findings attest to the utility of the person-centered approach in the context of EI research.

Despite these advantages, this research has its limitations. First, the sample size was relatively small across all studies. This weakness was particularly marked in the physiological studies (Studies III and IV). Since small sample size reduces the power of statistical analyses, the present results run the risk of type II error, or failure to reject a false null hypothesis, and hence should be interpreted with caution. Second, because the samples used in this research were all drawn from Japanese populations in specific domains (eldercare nurses and undergraduate students), the present findings cannot simply be generalized beyond these populations.

Third, the present research did not take the influence of the Big Five personality traits into account, despite the possibility of overlap between the Big Five and trait EI (e.g., Siegling, Furnham, & Petrides, 2015). Personality research has attested to the effects on well-being of some basic personality traits. For example, in a review, Lahey (2009) reported that neuroticism is a salient predictor of a wide variety of illnesses, frequent use of health services, and lowered quality of life. A more recent review on personality, well-being, and health by Friedman and Kern (2014) concluded that conscientiousness is a credible antecedent of global wellness and even longevity. Thus, it is unsure whether the present findings would remain, if the effects of these higher-order personality characteristics were controlled for. Nevertheless, there is growing evidence of the incremental validity of trait EI over and above that of the Big Five personality traits in predicting various well-being criteria (see the meta-analysis by Andrei et al., 2015).

In addition, in all the original studies, the possibility of social desirability bias, to which self-report questionnaires on personality are vulnerable (Edwards, 1957), was not taken into account. Hence, the results should be interpreted with this possibility in mind. However, precisely how much of a problem social desirability bias is in distorting responses in personality measures is a matter of debate. Several studies have provided reliable evidence to show that

for some personality scales adjusting the variance for social desirability failed to increase the validity of the measurements (McCrae & Costa, 1983, Pauls & Stemmler, 2003; see also the meta-analysis by Ones, Viswesvaran, & Reiss, 1996).

Fourth, the two psychological studies (Studies I and II) were based on a cross-sectional study design; therefore, the results do not reveal the causal relationship between the study variables. To achieve this objective would require a longitudinal study design. The results of the mediation models investigated in Study II should, in particular, be confirmed with longitudinal data.

Fifth, in addition, these two studies (Studies I and II) relied exclusively on self-ratings (self-report questionnaires) as the method of measurement. Hence, interpretation of the findings should take into account the possibility of common method bias, which distorts (attenuates or inflates) the associations between the study variables (Spector & Brannick, 2010). This risk may be effectively reduced by methodological measures, such as using others' ratings and secondary data sources (e.g., company records, biomarkers), as well as by controlling for, e.g., social desirability, marker variables, and general factors (Podsakoff, MacKenzie, & Podsakoff, 2012).

Sixth, while Study II focused on one psychosocial mediators (i.e., social support and one well-being indicator (i.e., work engagement) on various alternatives have been proposed. Zeidner et al. (2012), for example, enumerates factors such as social anxiety, treatment of social conflict, and coping with social demands as potential psychosocial mediators. For the indicator of well-being, the cognitive aspects of well-being (e.g., life satisfaction: see Pavot & Diener, 2008), eudaimonic well-being (e.g., meaning in life), and physiological well-being (e.g., cortisol awakening response) would be typical candidates. In light of the relative emphasis on SWB of EI research in this field so far, it would be particularly interesting to investigate whether the benefit of trait EI for psychosocial factors is translated into physiological well-being.

Seventh, with respect to the physiological studies (Studies III and IV), the extent to which the participants complied with the instruction to refrain from stimulants to physiological activity (e.g., smoking, eating) before the investigations is unknown. However, it is important to note that no sample displaying the extreme value of HRV (HR, HF, and LF/HF) was found in Study III, and that sAA specimens showing ± 3 SD from the mean were excluded from the statistical analysis in Study IV.

Moreover, in Study IV, although participants were supposed to collect saliva from under the tongue (i.e., sublingual salivary gland area), whether this was done in all cases cannot be guaranteed. Notwithstanding, the present samples showed similar diurnal variation as would be expected from sAA secreted from the sublingual salivary glands (see Harmon et al., 2008; Irie, Kojima, & Mori, 2012). It is important to mention that sAA collected from this salivary gland area was found to be a more authentic (stable) indicator of sympathetic activity compared to sAA collected from the other salivary gland areas (the parotid and submandibular gland areas). However, as shown by Harmon et al. (2008), diurnal variation in sAA may vary across salivary glands; and thus, the

argument remains as to which salivary glands provide the best sample of sAA as a surrogate of day-to-day variation in sympathetic activity.

Finally, the present physiological studies (Studies III and IV) only addressed the indicators of the ANS (i.e., HRV, sAA), despite the evidence that it collaborates with the HPA axis in the process of physiological well-being (Andrews et al., 2013; Pruessner & Ali, 2015). Importantly, the study by Ali and Pruessner (2012) showed evidence that the salivary alpha-amylase/cortisol ratio may outperform either single index in the ability to predict physiological well-being. Thus, additional physiological studies on trait EI that include both indices are required.

4.5 Implications and future research directions

This research has several theoretical and practical implications. The present findings support the theoretical prediction on the nexus between EI and well-being (Salovey & Mayer, 1990; Zeidner et al., 2012). Higher emotional capacity promotes better SWB, whereas poorer emotional ability elicits psychological malaise. Moreover, the present findings tell us that not only the overall level of trait EI, but also the pattern of the scores on its components has consequences for SWB. This finding supports Petrides (2011), who proposes that since trait EI is multi-dimensional personality profile, the adaptability of the construct can also be determined by the extent to which a given profile matches the requirements of the environment. Consequently, the present findings underscore the effectiveness of the person-centered analytic approach in the context of EI research. The use of this analytic approach allows researchers to identify sub-categories of trait EI which may be overlooked when using the variable-centered approach. It has, therefore, the potential for producing results which might pave the way for further theoretical reinforcement or refinement. Thus, more active utilization of this analytic approach in EI research is called for.

Moreover, the present research provides evidence to suggest that trait EI benefits well-being also at the physiological level. Higher trait EI may be linked to more adaptive physiological activity both in the face of acute stress and in the cycle of stress and recovery in daily life. Along with earlier cognate evidence, these findings may be of importance for complementing the current theoretical description of the nexus between EI and SWB from the biological point of view. Nonetheless, investigation of the physiological impact of trait EI has not yet got under way. In Japan, for example, there is no biological study on the construct other than the two studies reported here (Studies III Study IV). Thus, further research efforts are needed to help fill this gap.

The findings of this research also support the interpersonal perspective of the theory of EI that links the construct to well-being, (i.e., the interpersonal mechanism; Zeidner et al., 2012). It is plausible that higher emotional ability improves psychosocial resources, which, in turn, improves socio-emotional well-being. Moreover, the present research goes one step further by providing

evidence that the indirect positive effect of trait EI on well-being may extend to employee performance. This finding motivates the integration of studies on well-being and performance which have thus far been treated separately in EI research. Given the possibility of their reciprocal association over time (Amabile et al., 2005; Judge et al., 2001), longitudinal studies comprehensively addressing these constructs may contribute to a deeper understanding of the benefit of trait EI, and possibly new theoretical indications or insights.

The results of this research confirm that the theoretical link between trait EI and well-being, which has mostly been empirically studied using samples drawn from Western populations, also held for the present samples of Japanese participants, thereby adding to the generalizability of the theory across cultures. It seems that for Japanese populations rooted in a collectivist culture, emotional skills and abilities are also key factors for maintaining an optimal level of well-being. Notwithstanding, it should be noted that evidence is emerging on the importance of the impact of culture on the trait EI-well-being nexus. A cross-cultural study of Germany (individualist culture) and India (collectivist culture) reported a substantial difference between the countries in the process through which trait EI affects SWB (Koydemir et al., 2013). Specifically, it was shown that the effect of trait EI on life satisfaction was fully mediated by affect balance in the German sample, whereas the link was fully mediated by social support in the Indian sample. These findings indicate that cultural norms and values may differentiate the affinity of trait EI to the mediating mechanism (i.e., intrapersonal mechanism or interpersonal mechanism). In countries with a collectivistic culture, such as Japan, psychosocial factors may be a more central mediating mechanism of trait EI and well-being than in countries with a more individualistic culture, where intrapersonal factors may have more pronounced significance. Unfortunately, Koydemir et al. (2013) is the only study thus far to have adduced evidence for this, and hence additional cross-cultural studies are needed to confirm this possibility.

The results of this research revealed that the profiles with higher scores on all three dimensions were more beneficial to SWB among the sample of Japanese eldercare nurses. This finding may be an immediate asset for organizations in this occupational field. For example, the manager of an organization may be able to screen candidates using the EQS (a trait EI measure used in this research) and employ individuals with more promising profiles such as the extremely high profile and the high profile. By assigning them to influential positions, e.g., as a group leader, it might even be possible to expect them to generate positive synergy with other employees (e.g., Harms & Credé, 2010). In the same way, the manager would be also able to ponder the employment of individuals with the risk profiles of trait EI (the disproportional profile, the low profile, the extremely low profile). If such individuals already exist in the organization, they should be identified, and appropriate interventions implemented early on. Managers should keep in mind that employee well-being has a large impact on organizational flourishing and success (e.g., Darr & Johns, 2008; Judge et al., 2001).

Finally, the findings of this research imply that enhancing trait EI may benefit individuals' well-being. Despite strong evidence of genetic influence on the construct (heritability estimates were .32 and .40 for global trait EI in research with twin and family designs, respectively; Vernon, Petrides, Bratko, & Schermer, 2008), several studies to date have suggested that EI is a learnable and trainable psychological construct, and thus a training program aimed at increasing EI may serve to promote well-being. For example, Slaski and Cartwright (2003) conducted knowledge- and skill-based EI training (e.g., a short lecture on EI, group discussion of emotional experiences) for managers once a week for a total of four weeks. They found that the managers who participated in the training program showed better well-being as well as higher trait EI than those in the control condition. Moreover, Ruiz-Aranda et al. (2012) developed an EI training program (the INTEMO program) which includes various interactive exercises and brainstorming about emotional abilities. They carried out a two-year intervention using the program with adolescents and found that the program was instrumental in increasing their psychological adjustment.

Despite these promising findings, questions remain to be answered. For example, what EI training content is best? What is the optimal EI intervention period? Researchers and practitioners need to grapple with these central issues in devising practical programs for training EI.

4.6 Conclusion

The results of the present research showed that a higher global score on trait EI was linked to better psychological state, such as higher work engagement, lower burnout, and lower depression, whereas a lower global score on trait EI was associated with more negative consequences. Moreover, the results revealed that not only the general bivariate criterion of trait EI (i.e., high global trait EI vs. low global trait EI), but also the pattern of the scores on the three dimensions of the construct may differentiate the outcomes on SWB. In the present sample (Japanese eldercare nurses), the extremely high profile was found to be the most favorable for SWB, whereas the disproportional profile was a risk factor for SWB. The present results also showed that persons with higher trait EI displayed adaptive autonomic activity in the stress condition and in the cycle of stress and recovery in day-to-day life compared to those with lower trait EI. Moreover, the results revealed that trait EI improved work engagement by increasing a sense of social support, which resulted in higher creativity at work. Trait EI further interacted with social support, with moderate or higher levels of trait EI allowing social support to sequentially enhance work engagement and employee creativity.

To conclude, the findings suggest that higher emotional capacity is more beneficial for well-being at both the psychological level (SWB) and physiological level (physiological well-being). In contrast, weaker emotional skills and competencies are more detrimental. In addition, the profile of trait EI with a

combination of relatively high interpersonal skills and very poor situational abilities may also present a risk for SWB (among eldercare professionals). Moreover, the results indicate that higher emotional capacity may make positive contributions to the process of well-being (social support promotes work engagement and subsequent creativity) in a linear and interactive fashion. These findings provide further support for the theory of EI linking the construct to well-being from both the intrapersonal and interpersonal perspectives (Mayer & Salovey, 1997; Mayer et al., 2008; Salovey et al., 1999; Salovey & Mayer, 1990; Zeidner et al., 2012). Sophisticated management of ones' own emotions contributes to achieving a greater sense of affective well-being. Moreover, high emotional capacity improves social competences, relationships, and engagement, which ultimately bring about a greater sense of socio-emotional well-being. The present findings extend the positive psychology literature on EI as a significant personal strength for human flourishing and success. Given the malleability of trait EI (e.g., Kirk et al., 2011; Ruiz-Aranda et al., 2012; Slaski & Cartwright, 2003), an important challenge for future research may be to devise and implement an effective EI training program.

YHTEENVETO (SUMMARY)

Piirrepohjainen tunneäly ja sen assosiaatiot subjektiiviseen ja fysiologiseen hyvinvointiin

Positiivisen psykologian nousun myötä myös tunneälyä (emotional intelligence) – kykyä käsitellä tunnelatautunutta tietoa – on tutkittu yhä enemmän hyvinvointi- ja terveystieteiden saralla. Useat viimeaikaiset meta-analyttiset tutkimukset ovat tuottaneet vahvaa näyttöä siitä, että tunneäly edistää keskeisesti ihmisen hyvinvointia. Merkittävää on kumulatiivinen näyttö siitä, että tunneäly saattaa olla muovautuva yksilöllinen resurssi. On näin ollen mahdollista, että tunneällyn vaikutuksia tutkitaan jatkossakin.

Nykyisessä tunneällyn tutkimuksessa on tunnistettu kaksi ensisijaista, eri mittausmetodiin pohjautuvaa, tunneällyn käsitettä (Petrides, 2011): kykypohjainen tunneäly ja piirrepohjainen tunneäly. Kykypohjaista tunneälyä mitataan kognitiivista suorituskykyä arvioivilla testeillä, kun taas piirrepohjaista tunneälyä arvioidaan yleensä itseraportointilomakkeilla. Kykypohjainen tunneäly tarkoittaa varsinaista kognitiivista tunnekykyä ja piirrepohjainen tunneäly yksilön omaa käsitystä tunnekapasiteetistaan.

Tämä väitöskirjatutkielma keskittyi piirrepohjaiseen tunneällyyn ja tutki sen yhteyksiä hyvinvointiin psykologisella (subjektiivinen hyvinvointi: SWB) ja fysiologisella tasolla (fysiologinen hyvinvointi). Tällä tutkielmalla oli neljä päätarkoitusta: Ensimmäisenä tarkoituksena oli tunnistaa tunneällyn profiilit ja tutkia niiden yhteyksiä subjektiiviseen hyvinvointiin (työhön sitoutuminen, työuupumus, masennus) (Tutkimus 1). Toisena tarkoituksena oli tarkastella tunneällyn roolia subjektiivisen hyvinvoinnin prosessissa (ts. sosiaalinen tuki vaikuttaa työn imu, joka puolestaan ennakoii luovuutta työssä) (Tutkimus 2). Kolmantena tarkoituksena oli tutkia tunneällyn yhteyksiä laboratorio-oloissa aiheutetun stressin psykologisiin ja fysiologisiin vasteisiin (Tutkimus 3). Neljäntenä tarkoituksena oli tutkia tunneällyn yhteyttä affekteihin (positiivinen affekti, negatiivinen affekti) ja fysiologiseen hyvinvointiin päivittäisessä stressin ja siitä toipumisen kehässä (Tutkimus 4).

Tämän tutkielman teoreettisena perustana toimi tunneälyteoria hyvinvoinnin kontekstissa (Mayer & Salovey, 1997; Mayer et al., 2008; Salovey et al., 1999; Salovey & Mayer, 1990; Zeidner et al., 2012). Teoria kuvaa tunneällyn ja hyvinvoinnin välistä yhteyttä intrapersonallisesta ja interpersoonallisesta näkökulmasta. Ensin mainittu näkökulma perustuu oletukseen, että tunteiden erinomainen hallinta johtaa parempaan hyvinvointiin. Jälkimmäinen näkökulma kuvaa mekanismia, jossa korkeampi tunnekapasiteetti lisää sosiaalisia kykyjä ja sitoutumista edistäen siten paremman hyvinvoinnin saavuttamista. Täydentävänä teoriana tässä tutkielmassa käytettiin lisäksi laajenna ja rakenna -teoriaa (broaden-and-built theory), joka tarjoaa perustellun pohjan positiivisten tunteiden merkityksestä ihmisen adaptiivisen toiminnan selittämisessä. Teorian erityisolemuksena on, että positiivisten tunteiden kokemus voimistaa kognitiivisia käyttäytymispotentiaaleja. Ne auttavat vuorostaan luomaan kestäviä yksilöllisiä

resursseja, jotka edistävät affektiivista hyvinvointia, ihmisen toimintaa ja sopeutumista.

Tutkimusten I ja II poikkileikkausaineisto on peräisin japanilaisilta vanhustenhoidon ammattilaisilta (N = 500). Tutkimus III perustuu alemmaa korkeakoulututkintoa suorittavilta opiskelijoilta kerättyyn aineistoon (N = 28). Tutkimuksessa IV käytettiin lyhytaikaisen seurantatutkimuksen (päiväkirja) aineistoa. Se kerättiin satunnaisotannalla 50 japanilaiselta työntekijältä, jotka olivat osallistuneet edelliseen kyselytutkimukseemme (Tutkimukset I ja II).

Käyttämällä henkilökeskeistä analyysiä (latentti profiilianalyysi) tutkimuksessa I tunnistettiin kuusi erillistä tunneälyn latenttia profiilia: (1) Erittäin korkea profiili (korkeimmat pisteet kaikissa tunneälyn komponenteissa, sekä suhteellisen matala interpersoonallinen tunneäly muihin ulottuvuuksiin verrattuna). (2) Korkea profiili (korkeat pisteet kaikissa tunneälyn komponenteissa). (3) Keskinertainen profiili (keskinkertaiset pisteet kaikissa tunneälyn komponenteissa). (4) Epäsuhertainen profiili (keskinkertaisen intrapersoonallisen, korkean interpersoonallisen ja huomattavan matalan tilannetunneälyn yhdistelmä). (5) Matala profiili (matalat pisteet kaikissa tunneälyn komponenteissa). (6) Erittäin matala profiili (matalimmat pisteet kaikissa tunneälyn komponenteissa). Lisäksi tuloksista selvisi, että sellaiset tunneälyn profiilit, joissa kaikki komponentit olivat korkeita, olivat yhteydessä parempaan subjektiiviseen hyvinvointiin (vähemmän työuupumusta ja masennusta, korkeampi työn imu), kun taas ne profiilit, joissa kaikki komponentit olivat matalampia, liittyivät kielteisempiin tuloksiin hyvinvoinnin kanalta. Tuloksista ilmeni myös, että erittäin korkeassa profiilissa oli korkein hyvinvointi (subjektiivinen hyvinvointi, työssä suoriutuminen). Epäsuhhaitaisen profiilin tulokset olivat suhteellisen kielteisiä indikoiden matalampaa hyvinvointia (korkeampi masennustaso, matalampi työssä suoriutuminen, keskinertainen työn imu).

Tutkimuksessa II havaittiin, että piirrepohjainen tunneäly edisti prosessia, jossa sosiaalinen tuki vaikuttaa hyvinvointiin, mikä puolestaan ennakoii luovuutta työssä. Piirrepohjainen tunneäly paransi käsitystä sosiaalisesta tuesta. Se puolestaan paransi subjektiivista hyvinvointia (työn imua) ja sitä seuraavaa luovuutta työssä. Tunneäly toimi edelleen vuorovaikutuksessa sosiaalisen tuen kanssa niin, että tunneälyn korkeammat tasot (keskinertainen tai korkeampi) mahdollistivat sen, että sosiaalinen tuki edisti työn imua ja tämä vuorostaan luovuutta työssä.

Tutkimus III osoitti, että korkea tunneäly on yhteydessä matalampiin psykologisiin ja fysiologisiin (HF) stressivasteisiin ennen akuutin psykososiaalisen stressin aiheuttamista (julkinen puhe tai päässä laskutehtävä) kuin matala tunneäly, vaikka se yhdistettiin korkeampaan stressireaktiivisuuteen mentaalissa tehtävissä. Tämän lisäksi korkea tunneäly liittyi myös parempaan psykologiseen ja fysiologiseen toipumiseen stressimanipulaation jälkeen verrattuna matalaan tunneälyyn.

Tutkimuksesta IV selvisi, että korkea tunneäly liittyi korkeampaan positiiviseen affektiin kolmena peräkkäisenä tutkimuspäivänä (työpäivä 1, vapaapäivä, työpäivä 2). Korkeasti tunneälykkäillä oli myös matalammat diurnaaliset syljen

alfa-amylaasiarvot (sAA) vapaapäivänä matalaan tunneällyn työntekijäryhmään verrattuna. Seuraavana työpäivänä sAA-arvoissa näytti edelleen olevan merkittävä ero eri tunneällyn tasoissa.

Yhdessä nämä tulokset viittaavat siihen, että korkeampi tunneäly on suotuisampi hyvinvoinnille sekä psykologisella tasolla (SWB) että fysiologisella tasolla (fysiologinen hyvinvointi). Sitä vastoin heikommät tunnekyvyt ovat haitallisia hyvinvoinnin kannalta. Profiilissa, jossa ihmistenvälisiin suhteisiin liittyvät tunnetaidot ovat vahvat ja tilannetaidot heikot, voi tunneäly olla mahdollinen subjektiivisen hyvinvoinnin riskitekijä erityisesti vanhustenhoitoammattilaisilla. Tulokset osoittavat lisäksi, että korkeampi tunneälykapasiteetti voi vaikuttaa positiivisesti hyvinvoinnin prosessiin sekä lineaarisella että interaktiivisella tavalla (ts. sosiaalinen tuki edistää työn imua ja siitä seuraavaa luovuutta). Nämä löydökset antavat lisätukea tunneällyn ja hyvinvoinnin yhteyden teoreettisille malleille (Salovey et al., 1999; Salovey & Mayer, 1990; Zeidner et al., 2012). On uskotavaa, että omien tunteidensa hyvä hallinta johtaa suurempaan affektiiviseen hyvinvointiin, ja että hyvä tunneälykapasiteetti parantaa sosiaalisia taitoja, ihmissuhteita ja työn imua, mikä voi parantaa hyvinvoinnin tunnetta. Tutkielman löydökset myös korostavat ja laajentavat kirjallisuudessa esitettyä käsitystä siitä, että positiivisessa psykologiassa tunneällyllä on keskeinen merkitys ihmisen kukoistamiseen ja menestymiseen.

Löydöksistä voidaan tehdä monia teoreettisia ja käytännön päätelmiä, ja ne ohjaavat mahdollisiin jatkotutkimusaiheisiin. Ensimmäinen teoreettinen päätelmä on, että henkilökeskeisellä lähestymistavalla pystytään tunnistamaan alaluokkia (profiileja), joita ei välttämättä pystytä huomaamaan perinteisellä muutujakeskeisellä lähestymistavalla. Siksi tämän analyysimenetelmän ak-tiivisempi hyödyntäminen tunneälytutkimuksessa voi tuottaa tuloksia, jotka saattavat laajentaa tämänhetkistä tunneälyteoriaa. Toinen päätelmä on, että tutkimus tunneällyn fysiologisesta vaikutuksesta voi viitoittaa tietä sellaisen perustan luomiseksi, joka selittää tunneällyn psykologiset edut myös fysiologisesta näkökulmasta. Kolmanneksi, koska hyvinvoinnin ja työssä suoriutumisen suhde on mahdollisesti vastavuoroinen (Amabile et al., 2005; Judge et al., 2001), näiden käsitteiden perinpohjainen tarkastelu samassa viitekehyksessä voisi syventää käsitystä tunneällyn merkityksestä hyvinvoinnille, ja tästä kerääntyvä tieto voisi johtaa uusiin teoreettisiin näkemyksiin.

Käytännön päätelmänä on ensinnäkin, että hoitoalan organisaatiot voivat hyödyntää EQS-lomakkeen (tunneällyn itseraportointilomake) tuloksia työvoiman hankinnassa. Voisi esimerkiksi olla mahdollista palkata hanakammin ihmisiä, joilla kaikki tunneälyprofiilin komponentit ovat korkeita, jotta organisaatio menestyisi paremmin. Toiseksi, tunneällyn "voimaannuttaminen" voisi auttaa parantamaan hyvinvointia (Kirk et al., 2011; Ruiz-Aranda et al., 2012; Slaski & Cartwright, 2003). On merkittävää, että tunneällyn on osoitettu olevan muovautuva psykologinen voimavara (esim., Kirk et al., 2011; Slaski & Cartwright, 2003), vaikka sen periytyvyys onkin huomattavaa (Vernon, et al., 2008). Jatkotutkimuksissa tulisi siten määrätietoisesti paneutua lisäkysymyksiin esimerkiksi parhaista tunneälykoulutuksista/-interventioista.

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ORIGINAL PAPERS

I

A LATENT PROFILE ANALYSIS OF TRAIT EMOTIONAL INTELLIGENCE TO IDENTIFY BENEFICIAL AND RISK PROFILES IN WELL-BEING AND JOB PERFORMANCE: A STUDY AMONG JAPANESE ELDERCARE NURSES

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A latent profile analysis of trait emotional intelligence to identify beneficial and risk profiles in well-being and job performance: a study among Japanese eldercare nurses

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Abstract: Trait emotional intelligence (EI) is a noteworthy psychological resource in nursing. However, its effects on well-being and job performance are inconsistent. Thus, we explored the latent beneficial and risk profiles of trait EI among 461 Japanese eldercare nurses. Latent profile analysis revealed six latent profiles. In addition, multivariate analysis of covariance (MANCOVA) showed that the profile with the highest overall scores on the trait EI dimensions was associated with the most beneficial outcomes (better well-being, higher job performance). In contrast, the profiles with lower overall scores on the trait EI dimensions showed negative outcomes. Moreover, a disproportional profile, characterised by higher interpersonal EI and lower situational EI, also showed poorer outcomes. The findings indicate that trait EI is associated with subjective well-being and job performance, depending both on the overall levels of trait EI and on the dimensionality of the sub-factors within the different trait EI profiles.

Keywords: trait emotional intelligence; trait EI; latent profile analysis; LPA; well-being, job performance; nurses; Japan.

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1 Introduction

Japan is one of the countries experiencing a dramatic increase in its aging population (Arai et al., 2015). In consequence, the provision of care for the elderly has increased in importance and its quality is largely contingent on the competence of nursing care staff (Furumura, 2011). In recent years, the structure of nursing care in Japanese special nursing homes has undergone sweeping reforms and is nowadays referred to as a unit care system (Harada and Miyawaki, 2013). However, a recent study reported that Japanese nurses showed significantly higher psychological symptoms, such as exhaustion and depression, than other occupational groups such as office workers, cooks and administrative workers (Harada and Miyawaki, 2013). It is not surprising that excessive nursing stress impairs well-being, e.g., work engagement (Zacher and Winter, 2011) and job performance (Zacher et al., 2012).

Trait emotional intelligence (trait EI) is a relatively new psychological resource which has received considerable attention as a significant facilitator of well-being and job performance (Martins et al., 2010; O'Boyle et al., 2011). Nevertheless, the effects of trait EI on such variables remain unclear, and research has not yet clearly demonstrated the characteristics of beneficial vs. risk profiles of trait EI. Therefore, the purpose of this study is to explore the beneficial and risk profiles of trait EI in terms of subjective occupational well-being (burnout, depression and work engagement) and job performance among Japanese eldercare nurses.

1.1 Theoretical background of EI

The research model of EI can be classified into two main categories (Petrides et al., 2007). The first is the trait EI model, which defines EI as a constellation of emotional self-perceptions located at the lower levels of personality hierarchies (Petrides et al., 2007). In other words, trait EI indicates personality traits that reflect subjective emotional dispositions and experiences related to emotion perception, expression evaluation and management (Petrides, 2011; Petrides and Furnham, 2004). This can be assessed with self-report questionnaires such as the trait emotional intelligence questionnaire (TEQue) (Petrides and Furnham, 2004), the bar-on emotion quotient inventory (EQ-i) (Bar-On, 1997) and the Schutte self-report emotional intelligence test (SSEIT) (Schutte et al., 1998).

The second category is the ability EI model that defines EI as “the abilities to perceive, appraise and express emotion; to access and/or generate feelings when they facilitate thought; to understand emotion and emotional knowledge and to regulate emotions to promote emotional and intellectual growth” [Mayer and Salovey, (1997), p.10]. In contrast to trait EI, ability EI is more closely associated with cognitive ability

regarding effective and adaptive emotion processing, which can be captured with cognitive performance tests requiring emotionally dynamic actions and processes (Petrides et al., 2007; Petrides, 2011) such as the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) (Mayer et al., 2002). Due to clear differences in measurement methods, the constructs of ability and trait EI are heterogeneous (Petrides et al., 2007; Petrides, 2011). Empirical studies have reported weak or orthogonal relationships between them (Davis and Humphrey, 2012; Di Fabio and Saklofske, 2014), which, in turn, lead to different outcomes in the association between well-being and job performance (Martins et al., 2010; O'Boyle et al., 2011). In this study, we focus on trait EI, which is typically measured by self-report questionnaires.

Although contemporary EI research has made considerable efforts to establish the universal applicability of EI, the abilities underlying trait EI may nevertheless be dependent on the cultural context, e.g., whether the target culture is collectivist or individualist (Gökçen et al., 2014; Matsumoto et al., 2008). In collectivist cultures, including Japan, interpersonal harmony and in group goals are more likely to be valued than personal independence and individuality (Matsumoto et al., 2008). For the cross-cultural validity of the measures of trait EI, Fukuda et al. (2011) showed that the measure, which was designed in an individualist culture, was not directly applicable to Japanese samples. Thus, it seems to be sensible to choose a scale suited to the norms and values of the target culture.

The emotional intelligence scale (EQS) (Otake et al., 2001) has since been developed and well-validated among Japanese employees across a wide range of occupations (see Otake et al., 2001; Uchiyama et al., 2001). Moreover, the EQS has the advantage of enabling a comprehensive assessment of EI from the two important perspectives of functionality (emotional abilities of perception, expression, utilisation and regulation) and subjectivity (the three dimensions) of EI (Otake et al., 2001; Uchiyama et al., 2001). In light of these benefits, we regarded the EQS as the best option for assessing trait EI among Japanese eldercare nurses. The EQS identifies three major dimensions of trait EI (henceforth EI): intrapersonal, interpersonal and situational (Otake et al., 2001; Uchiyama et al., 2001). Intrapersonal EI refers to the ability to perceive and understand one's own emotions and to properly express and control one's own feelings and thoughts. Interpersonal EI indicates the ability to perceive and understand others' feelings and emotions to create desirable social relationships. Situational EI, which was later added to measure broader social interactions, refers to the ability to adjust the functions of the other EI dimensions in order to achieve effective emotion management and flexible adaptation to various situational changes.

In the following sections, we describe subjective well-being and job performance and review the effect of EI on these factors in the nursing context.

1.2 Subjective well-being and job performance in nursing

In health care work, nurses are often confronted with stressful situations, such as serious diseases and the death of patients (Augusto-Landa et al., 2008), which, in turn, can accelerate psychological pathologies (Görgens-Ekermans and Brand, 2012; Trépanier et al., 2014). A typical mental illness in eldercare nurses is burnout (Augusto-Landa and López-Zafra, 2010; Moroi, 1999); it is referred to as a syndrome characterised by emotional exhaustion, depersonalisation and attenuated personal accomplishment (Leiter and Maslach, 1988). Burnout shares many similarities with depression in its

etiological pathways and common symptoms, such as significant fatigue, depressive mood and anxiety (Bianchi et al., 2015).

In contrast, abundant job-related resources can enhance nurses' positivity and motivation (e.g., Mauno et al., 2007), that is, work engagement which indicates "a positive, fulfilling, work-related state of mind that is characterised by vigor, dedication, and absorption" [Schaufeli et al., (2002), p.74]. Hence, individuals with higher work engagement tend to achieve higher care performance (Salanova et al., 2011).

1.3 The role of emotional intelligence in nursing

Several studies have indicated the positive role of EI in psychosomatic health. For instance, in the face of the emotional labour of nursing work, higher EI was found to predict lower burnout and somatic complaints (Mikolajczak et al., 2007; Santos et al., 2015). Another study reported that EI has a significant moderating effect on the relationship between occupational stress and burnout among nurses; it also demonstrated that higher EI was associated with decreased risk for burnout among individuals with chronic occupational stress (Görgens-Ekermans and Brand, 2012). Consistent with these empirical findings, a meta-analysis revealed that EI is positively associated with psychosomatic health (Martins et al., 2010).

In addition, EI was also found to have a significantly positive effect on work engagement in nurses (Nel et al., 2013; Zhu et al., 2015). Some studies also have reported a positive relationship between EI and work engagement in other professions (Brunetto et al., 2012; Schutte and Loi, 2014). In particular, EI was the most significant positive predictor of work engagement when compared with the 'big five' personality dimensions (Akhtar et al., 2015). Moreover, a meta-analysis indicated the importance of EI in predicting higher job performance (O'Boyle et al., 2011). In support of this analysis, higher EI (as a dimension of situational EI) was subsequently found to be crucial for higher job performance among Japanese nurses (Fujino et al., 2015). However, such studies have seldom been conducted in an Asian context (for exceptions, see Fujino et al., 2015). Accordingly, in this study, we examine whether these relationships are also present in the Japanese nursing context.

1.4 The negative outcomes in different EI profiles

In contrast to such positive findings, some previous studies have indicated that EI can have adverse effects on well-being or health. For example, individuals with a higher EI sub-factor of emotional perception reported adverse psychological health symptoms such as depression, hopelessness and suicidal ideation more often than those with lower EI (Ciarrochi et al., 2002). In addition, individuals with a higher EI sub-factor of emotional attention reported greater symptoms of ill health (Goldman et al., 1996). In accordance with this finding, Aradilla-Herrero et al. (2014) documented that nursing students with higher emotional attention displayed heightened emotional susceptibility and increased risk of suicide.

Furthermore, a combination of high emotional attention with low emotional clarity and repair has been associated with negative health outcomes (Gohm and Clore, 2002). In an experimental study, individuals with high emotional clarity and low emotional repair showed higher emotional reactivity to the experimental stimulus and a lower rate of recovery afterwards (Fernández-Berrocal and Extremera, 2006). Moreover, a mood

induction study by Gohm (2003) revealed four profiles of EI. The participants with a profile of high attention, clarity and high emotional intensity reacted more strongly to emotional situations and also maintained their negative mood longer. Another study, which utilised the EQ-i (Bar-On, 1997), identified six to seven EI profiles for each gender and found that high scores for intrapersonal EI and moderate levels of interpersonal EI buffered against burnout in nurses (Gerits et al., 2005). However, the EI profile with the highest scores on these dimensions was not associated with any reduction in burnout. Finally, the authors argued that lower interpersonal EI can be an effective coping mechanism as it prevents nurses from developing excessive empathy with patients.

1.5 The present study

These findings, considered together, indicate two important issues: first, higher EI is not always a beneficial psychological quality for an employee's well-being and second, the role of EI in the workplace is likely to be dependent on its specific profile. In support of these notions, Petrides (2011) argued that higher EI does not necessarily lead to positive outcomes, but rather that the functions of EI largely depend on contextual and behavioural factors. That is, it raises the possibility that potential profiles of EI that are related to beneficial and risk outcomes may exist not only in the levels of the dimensions of EI (high vs. low) but also in relation to the combination of different dimensions. However, in Japan, research on EI profiles is still in its early stages, and hence empirical evidence on nurses' EI profiles is limited. Therefore, what characterises beneficial and risk profiles of EI, respectively, remains unanswered. Thus, the purpose of this study is to reveal the latent profiles of EI and to identify which are beneficial and which put the individual at risk by comparing subjective well-being (burnout, depression and work engagement) and job performance among Japanese eldercare nurses. Taking the findings reported above into account, we formulated five hypotheses as follows:

- Hypothesis 1 (H1) Latent profile analysis (LPA) will reveal different EI profiles (Fernández-Berrocal and Extremera, 2006; Gerits et al., 2005; Gohm, 2003).
- Hypothesis 2 (H2) EI profiles with higher overall EI dimension will be associated with better subjective well-being and higher job performance (Görgens-Ekermans and Brand, 2012; Mikolajczak et al., 2007).
- Hypothesis 3 (H3) EI profiles with lower interpersonal EI compared with other EI dimensions within the profile will also be associated with better outcomes (Fujino et al., 2015; Grits et al., 2005).
- Hypothesis 4 (H4) EI profiles with lower overall EI dimension scores will be associated with poorer well-being and lower job performance (Görgens-Ekermans and Brand, 2012; Mikolajczak et al., 2007).
- Hypothesis 5 (H5) EI profiles with higher interpersonal EI compared with other EI dimensions within the profile will also be associated with poorer outcomes (Fujino et al., 2015; Gerits et al., 2005).

2 Method

2.1 Participants and procedure

This study utilised a cross-sectional design. We recruited 500 eldercare nurses from special nursing homes in Japan. First, we presented an overview of our study to the potential participants and undertook to strictly protect their personal information and privacy. Participants then voluntarily provided their informed consent.

Next, we distributed a set of questionnaires to the participants along with the instruction to answer them carefully. On completion, the participants returned the questionnaires to their managers. Completed questionnaires were collected after one month from 494 nurses; the response rate was thus 98%. After excluding incomplete questionnaires, data from 461 participants [female = 377 (81.8%); male = 84 (18.2%)] were eligible for the analyses. The mean age of the participants was 38.9 years ($SD = 11.0$).

2.2 Measures

EI was assessed by the EQS (Otake et al., 2001), which has been validated in Japan (Otake et al., 2001; Uchiyama et al., 2001). The scale comprises 65 items, 21 for each of the three EI dimensions, i.e., Intrapersonal, Interpersonal and Situational and two lie items. Further, each dimension comprises three sub-factors, making nine in total. Intrapersonal EI comprises self-awareness (SA) (e.g., “I am aware of changes in my feelings”); self-motivation (SM) (e.g., “I like to find significant value in any task that I do”); and self-control (SC) (e.g., “I am able to keep calm and not raise my voice even when I am offended”). Interpersonal EI comprises empathy (EM) (e.g., “when I see someone in distress, I cannot help talking to them”); altruism (AL) (e.g., “I feel compelled to help those stricken by disaster”); and interpersonal relationships (IR) (e.g., “I can get along with anyone without attempting to please everyone”). Situational EI comprises situational awareness (SIA) (e.g., “I always see the positive side of an issue or challenge”); leadership (LS) (e.g., “I am capable of being a leader in a group situation”); and flexibility (FX) (e.g., “when necessity dictates, I can suggest new ways of solving a problem”). The items were scored on a four-point Likert scale from 0 (*totally disagree*) to 4 (*totally agree*). In the present study, we applied the nine-sub-factor structure of the scale. The Cronbach’s alpha for the total scale was .97 [intrapersonal EI = .91 (SA = .75, SM = .85, SC = .81); interpersonal EI = .92 (EM = .81, AL = .86, IR = .84); situational EI = .93 (SIA = .81, LS = .89, FX = .85)].

Burnout was assessed by the 17-item Japanese Burnout scale (JBS) (Tao and Kubo, 1996). The items form three sub-factors which assess occupational well-being during the past six months: emotional exhaustion (e.g., “I feel I am stressed out mentally and physically”); depersonalisation (e.g., “I feel I don’t want to see my colleagues’ and patient’s faces”); and personal accomplishment (e.g., “I feel pleasure from the bottom of my heart after completing my tasks”). The items were scored on a five-point Likert scale from 1 (*never*) to 5 (*always*). In this study, the total score was used. The Cronbach’s alpha for the scale was .88.

Depression was assessed with the Zung self-rating depression scale (SDS) (Zung, 1965), which consists of 20 items (e.g., “I feel down-hearted and blue”). The items were

scored on a four-point Likert scale from 1 (*rarely*) to 4 (*most of the time*). In this study, the total score was used. The Cronbach's alpha for the scale was .82.

Work engagement was assessed by the Japanese version of the Utrecht Work Engagement Scale (UWES-J) (Shimazu et al., 2008), which consists of 17 items corresponding to the underlying three dimensions of work engagement: vigour (e.g., "at my job, I feel strong and vigorous"); dedication (e.g., "I am enthusiastic about my job"); and absorption (e.g., "when I am working, I forget everything else around me"). The items were scored on a six-point Likert scale from 0 (*never*) to 6 (*always*). In this study, the total score was used. The Cronbach's alpha for the scale was .93.

Self-rated job performance was assessed by the subscale of the New Brief Job Stress Questionnaire (New BJSQ) (Inoue et al., 2014). The total score of three items assessing performance of a duty was used (e.g., "I did my work better than others"). The items were scored on a four-point Likert scale from 1 (*disagree*) to 4 (*agree*). The Cronbach's alpha for the scale was .81.

2.3 Statistical analysis

2.3.1 Latent profile analysis

We performed LPA with the nine sub-factors of the EQS to identify latent profiles of EI by using Mplus Version 6 (Muthén and Muthén, 2010). LPA is a more accurate statistical method than traditional cluster analysis for identifying latent taxonomies (Cleland et al., 2000) and has been used earlier, for example in coping (Mauno et al., 2014) and EI research (Keefer et al., 2012).

The upper limit of the potential number of latent profiles was determined by the changes in the p -value of the parametric bootstrap likelihood ratio test (BLRT) and by practical sample size. The p -value ($p < .01$) of the BLRT indicates the level of statistical significance of the difference in log-likelihood in comparison with the next lower latent profile. For the model determination criteria, the Akaike information criterion (AIC), the Bayesian information criterion (BIC), the adjusted Bayesian information criterion (adj. BIC), entropy, BLRT and practical sample size were all applied. In general, the lower the value of the model information indices (AIC, BIC and adj. BIC), the better the model fit (Nylund et al., 2007). Nevertheless, a recent simulation study found that the BIC was superior to the other model information indices in the identification of the best-fitting model (Nylund et al., 2007). Therefore, the value of BIC was emphasised in the present analysis. For the criterion of classification accuracy, we used an entropy value of above 0.80, which indicates a well-classified solution, with higher scores indicating increasing classification accuracy (Ramaswamy et al., 1993). Finally, we determined the best model by comprehensively taking account of the model information properties, classification accuracy, substantive meaning of each solution, parsimony and the research purpose (see Bauer and Curran, 2003; Lubke and Muthén, 2005).

2.3.2 *Comparison of subjective well-being and job performance across the latent profiles*

We performed multivariate analysis of covariance (MANCOVA) to examine the group differences between the EI profiles in subjective well-being (burnout, depression and work engagement) and job performance, controlling for the potential confounding effects of gender, age, educational background, employment type (permanent, contract and temporary or full- vs. part-time employee) and shift type. All the examined variables were approximately normally distributed. In addition, we confirmed that our data satisfied the statistical assumptions of the homogeneity of variance-covariance matrices and error variances with Box's and Levene's test, respectively. Effect sizes were reported as partial eta-squared (η_p^2) values. The MANCOVA was performed using SPSS version 21.0.

3 Results

3.1 *Identifying latent profiles of EI*

Table 1 shows the changes in the indices across the nine models.

Although the BLRT remained significant for the nine-profile solution, there was an upturn in the BIC value for this solution. Moreover, it yielded the largest number of small sample sizes, accounting for 10% of the total sample size. Therefore, the eight-profile solution was determined as the upper limit of the potential number of latent profiles. All the model information indices decreased as the number of latent profiles increased, reaching their lowest values at the eight-profile solution. However, the seven- and eight-profile solutions were relatively less parsimonious, as they included more than two small profiles accounting for 10% of the sample size. Simultaneously, the entropies were relatively lower for these solutions than for the six-profile solution. In addition, a significantly unique EI profile (labelled the disproportional profile in the next section) first emerged in the six-latent profile solution. Thereafter, unique profiles were no longer detected; instead, along with the increase in the number of latent profiles, each profile was simply further subdivided. This continuing subdivision of the sample sizes in the seven- and eight-profile solutions was considered to be inappropriate in light of the purpose of the study. Thus, we concluded that the six-profile solution, which showed the lowest (among the one- to six-profile solutions) model information indices, a sufficient level of classification accuracy and a balanced sample size across the profiles, was the most optimal classification. The sample size of each latent profile in the six-profile solution was 16 (3.4%), 70 (15.2%), 154 (33.4%), 53 (11.5%), 109 (23.6%) and 59 (12.8%).

Table 1 LPA goodness-of-model-fit-indices

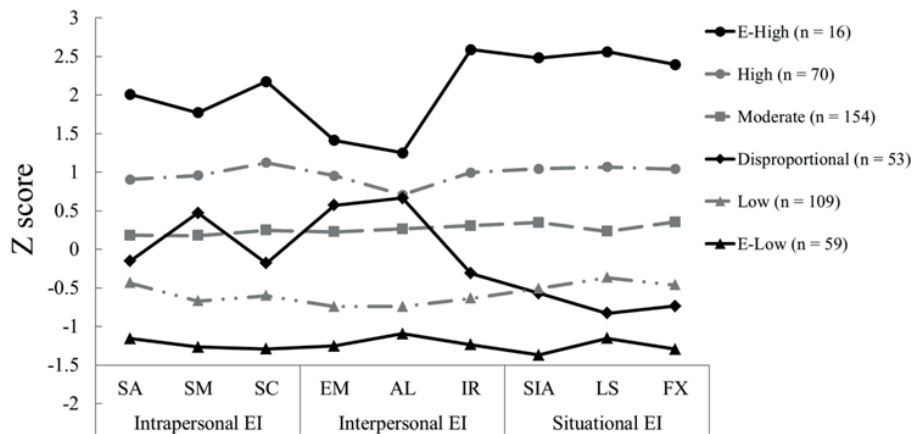
	Model fit indices				BLRT	Entropy	Sample size under 10%	Minimum sample size
	AIC	BIC	Adj. BIC	BLRT				
1 Profile solution	11801.34	11875.74	11818.61					
2 Profile solution	10190.72	10306.46	10217.59	-13411.88	($p < .01$)	0.886	0	49.0%
3 Profile solution	9523.36	9680.43	9559.83	-5067.36	($p < .01$)	0.907	0	13.9%
4 Profile solution	9198.43	9396.84	9244.50	-4723.68	($p < .01$)	0.899	1	3.5%
5 Profile solution	9028.69	9268.42	9084.35	-4551.22	($p < .01$)	0.880	1	3.5%
6 Profile solution	8909.64	9190.71	8974.90	-4456.34	($p < .01$)	0.874	1	3.5%
7 Profile solution	8829.75	9152.15	8904.60	-4386.82	($p < .01$)	0.864	2	3.0%
8 Profile solution	8784.01	9147.75	8868.46	-4355.41	($p < .01$)	0.867	3	0.4%
9 Profile solution	8746.56	9151.63	8840.60	-4304.13	($p < .01$)	0.867	4	0.4%

Note: $N = 461$

3.2 Descriptions of the latent EI profiles

The first profile was characterised by the highest levels of overall EI compared with the other profiles. Within the profile, interpersonal EI (in particular, empathy and altruism) was at a significantly lower level than the other (two) dimensions of EI. Accordingly, this profile was labelled the extremely high profile (E-high; $n = 16$). The second profile showed relatively higher levels of overall EI, and all the dimensions were at approximately the same level within the profile. Thus, this profile was labelled the high profile (high; $n = 70$). The third profile showed moderate levels of EI, with no significant differences between the dimensions within the profile. Therefore, this profile was labelled the moderate profile (moderate; $n = 154$). The fourth profile was characterised by higher levels of interpersonal EI (in particular, empathy and altruism), moderate levels of intrapersonal EI and lower levels of situational EI. Accordingly, this profile was labelled the disproportional profile (disproportional; $n = 53$). The fifth profile showed relatively lower levels of overall EI, with all the dimensions at approximately the same level within the profile. Thus, the profile was labelled the low profile (low; $n = 109$). The sixth profile was characterised by the lowest levels of overall EI, and there were no significant differences between the levels of the dimensions within the profile. Thus, the profile was labelled the extremely low profile (E-low; $n = 59$). Therefore, H1 was supported. The six latent profiles are illustrated in Figure 1.

Figure 1 Visual representation of the six latent profiles on the subscales of EI



Notes: $N = 461$, SA = self-awareness, SM = self-motivation, SC = self-control, EM = empathy, AL = altruism, IR = interpersonal relationship, SIA = situational awareness, LS = leadership, FX = flexibility

3.3 Differences in well-being and job performance across the profiles

The results of the MANCOVAs are illustrated in Table 2.

Table 2 Statistical differences in subjective well-being and job performance between the six latent profiles of EI

	Latent profiles of emotional intelligence (N = 461)						F (η^2)	Paired comparisons
	E-High (n = 16)	High (n = 70)	Moderate (n = 154)	DP (n = 53)	Low (n = 109)	E-Low (n = 59)		
Burnout	M	38.94	44.43	46.14	49.60	49.01	52.39	E-H < M ($p < .05$), DP, L, E-L ($p < .01$) H < L ($p < .05$), E-L ($p < .01$) M > E-H ($p < .05$); M < E-L ($p < .01$) L > H ($p < .05$), E-H ($p < .01$) E-L > M, H, E-H ($p < .01$) DP > E-H ($p < .01$)
	(SD)	(8.01)	(6.07)	(6.61)	(6.62)	(6.87)	(7.93)	
Depression	M	35.44	41.13	41.62	48.92	44.54	48.41	E-H < M ($p < .05$), DP, L, E-L ($p < .01$) H < E-L, DP ($p < .01$) M < DP, E-L ($p < .01$); M > E-H ($p < .05$) L < DP ($p < .05$); L > E-H ($p < .01$) E-L > M, H, E-H ($p < .01$) DP > L ($p < .05$), M, H, E-H ($p < .01$)
	(SD)	(5.95)	(5.24)	(5.03)	(6.28)	(5.63)	(5.16)	
Work engagement	M	64.38	61.50	55.32	50.72	48.44	40.66	E-H > M ($p < .05$), E-L, L, DP ($p < .01$) H > E-L, L, DP ($p < .01$) M > L, E-L ($p < .01$) L < M, H, E-H ($p < .01$) E-L < DP ($p < .05$), M, H, E-H ($p < .01$) DP > E-L ($p < .05$); DP < E-H ($p < .05$), H ($p < .01$)
	(SD)	(11.98)	(10.97)	(11.43)	(11.15)	(9.70)	(12.71)	
Job performance	M	10.25	8.51	8.44	7.53	7.95	7.27	E-H > H, M, DP, L, E-L ($p < .01$) H > E-L, DP, E-H ($p < .01$) M > E-L, DP ($p < .01$); M < E-H ($p < .01$) L < E-H ($p < .01$) E-L < M, H, E-H ($p < .01$) DP < M, H, E-H ($p < .01$)
	(SD)	(1.05)	(1.21)	(0.96)	(1.06)	(0.98)	(1.20)	

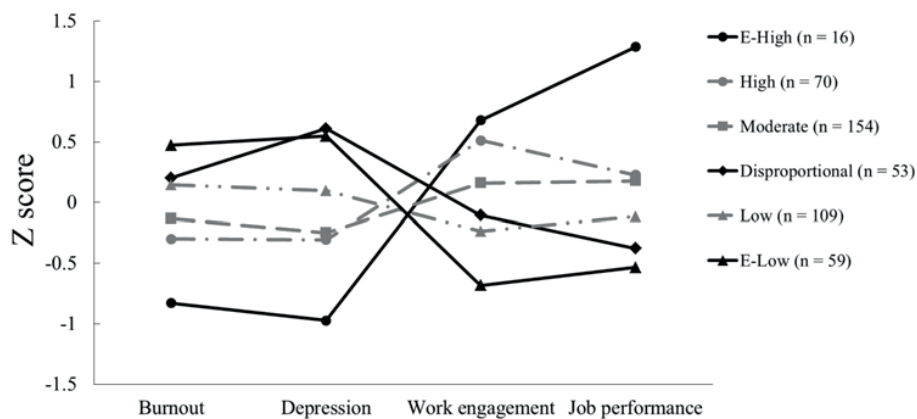
Notes: E-H = the extremely high profile of EI; H = the high profile of EI; M = the moderate profile of EI;
 DP = the disproportional profile of EI; L = the low profile of EI; E-L = the extremely low profile of EI
 *** $p < .001$

The multivariate test of MANCOVA yielded a significant overall main effect for the EI profiles ($F(20, 1,483) = 8.43$, Wilk's $\lambda = 0.70$, $p = .000$, $\eta_p^2 = 0.09$). The follow-up ANCOVAs revealed significant differences for burnout ($F(5, 450) = 7.98$, $p = .000$, $\eta_p^2 = 0.08$), depression ($F(5, 450) = 14.48$, $p = .000$, $\eta_p^2 = 0.14$), work engagement ($F(5, 450) = 15.29$, $p = .000$, $\eta_p^2 = 0.15$) and job performance ($F(5, 450) = 15.20$, $p = .000$, $\eta_p^2 = 0.14$).

Post-hoc pairing comparisons with Bonferroni correction were performed to identify the differences in subjective well-being and job performance between the six latent profiles. We found that the high and E-high profiles, marked by higher levels of overall EI, were associated with lower levels of burnout and depression, and with higher levels of work engagement and job performance. In particular, the E-high profile, characterised by relatively lower levels of interpersonal EI within the profile, showed the highest levels of job performance. Therefore, H2 was supported and H3 was partially supported. These results indicate that the high and E-High profiles can be beneficial profiles of EI.

In contrast, the low profile, marked by lower levels of overall EI, was associated with higher levels of burnout, slightly higher depression, lower work engagement and slightly lower job performance. Moreover, the E-low profile, marked by the lowest levels of overall EI, was associated with higher levels of burnout and depression and lower levels of work engagement and job performance. In addition, the disproportional profile, characterised by relatively higher levels of interpersonal EI, moderate levels of intrapersonal EI and lower levels of situational EI within the profile, showed slightly higher levels of burnout, higher levels of depression, moderate levels of work engagement and lower levels of job performance. Therefore, H4 was supported and H5 was partially supported. The results suggest that the low, E-low and disproportional profiles can be risk profiles of EI. The visual representation of the results is presented in Figure 2.

Figure 2 Visual representation of the differences in subjective well-being and job performance between the six latent profiles



Note: $N = 461$

4 Discussion

The purpose of this study was to reveal latent profiles of EI and to identify beneficial and risk profiles of trait EI in relation to subjective occupational well-being (burnout, depression and work engagement) and job performance among 461 Japanese eldercare nurses by applying a cross-sectional study design. This is the first study of EI profiling that has been conducted among Japanese eldercare nurses.

We expected that LPA would reveal different EI profiles, and that the EI profiles with relatively higher scores across the dimensions but with lower interpersonal EI within the profile would be associated with better subjective well-being and higher job performance. In contrast, the EI profiles with relatively lower overall scores and with higher interpersonal EI within the profile would show poorer outcomes. Our analysis yielded six latent profiles of EI, all of which supported our H1. This result is consistent with several empirical studies demonstrating the presence of different EI profiles (Fernández-Berrocal and Extremera, 2006; Gerits et al., 2005; Gohm, 2003; Keefer et al., 2012). In addition, we identified latent beneficial (high and E-high) and risk (low, E-low and disproportion) profiles, which partially supported the remaining hypotheses.

4.1 *The beneficial profiles of EI*

The high and E-high profiles of EI showed better subjective well-being and higher job performance, thereby supporting H2. These results are congruent with previous findings that higher EI is associated with better mental health (Görgens-Ekermans and Brand, 2012; Martins et al., 2010; Mikolajczak et al., 2007; Santos et al., 2015), higher work engagement (Nel et al., 2014; Zhu et al., 2015) and better job performance (Fujino et al., 2015; O'Boyle et al., 2011).

Moreover, it is noteworthy that the E-High profile, which is characterised by lower interpersonal EI (in particular, empathy and altruism) compared to the scores for the other dimensions, resulted in the most beneficial outcomes, thereby partially supporting H3. In support of this finding, several studies have indicated that higher empathy may not always be associated with positive outcomes. For instance, although empathy is considered a central factor in establishing a superior professional-client partnership in nursing (Augusto-Landa and López-Zafra, 2010), excessive empathy was a risk factor for compassion fatigue (Wentzel and Brysiewicz, 2014), burnout (Tei et al., 2014) and depression (Schieman and Turner, 2001). Moreover, a similar finding has also been reported for altruism (Altun, 2002). Accordingly, it might be speculated that lower interpersonal EI in the E-high profile may have the effect of preventing nurses from experiencing excessive empathy towards nursing home residents (Gerits et al., 2005). In addition, given the evidence that intrapersonal and situational EI have been found to be specifically crucial dimensions for better mental health (Gerits et al., 2005) and job performance (Fujino et al., 2015; Gerits et al., 2005; Imura et al., 2012), it is arguable that this dimensionality of EI may benefit eldercare nurses.

4.2 *The risk profiles of EI*

In contrast, the low and E-low profiles of EI showed lower levels of subjective well-being and job performance, thereby supporting H4. This result is congruent with previous studies indicating that lower EI is associated with poorer health

(Görgens-Ekermans and Brand, 2012; Martins et al., 2010; Mikolajczak et al., 2007; Santos et al., 2015), work engagement (Nel et al., 2014; Zhu et al., 2015) and lower job performance (Fujino et al., 2015; O'Boyle et al., 2011).

More interestingly, the disproportional profile, characterised by higher interpersonal EI (particularly, empathy and altruism), moderate intrapersonal EI and lower situational EI, also showed poorer outcomes, which partially supported H5. The result is in line with the Petrides (2011), who argued that higher EI is not always associated with positive outcomes in certain situations. As previously mentioned, excessive empathy and altruism can accelerate psychological ill health (Altun, 2002; Schieman and Turner, 2001; Wentzel and Brysiewicz, 2014). Accordingly, one potential explanation for this result could be that higher interpersonal EI might lead to higher empathetic stress, which is reflected in poorer subjective well-being and lower job performance (Gerits et al., 2005). In addition, nurses are often required to deal with their own and others' emotions in the process of taking immediate appropriate actions in various situations (Fujino et al., 2015). Therefore, lower situational EI might also contribute to such negative outcomes, as this dimension plays an important role in adaptive stress management and flexible situational processing (Uchiyama et al., 2001). Finally, it is also important to note that the nurses with this profile showed moderate work engagement in spite of their slightly higher burnout and significantly higher depression levels. This might reflect the potentially ambivalent outcome of higher interpersonal EI. Therefore, further research is required to address this phenomenon. Considering these together, it can be argued that this dimensionality of EI may also be a potential risk for eldercare nurses.

In conclusion, our results suggest that the EI profile characterised by lower interpersonal EI and higher scores on the other dimensions within the profile, is likely to be the most beneficial profile of EI in terms of subjective well-being and job performance. In contrast, the EI profiles showing lower scores throughout the EI dimensions could indicate a significant risk. The disproportional EI profile, characterised by higher interpersonal EI and lower situational EI, could also be considered a risk profile of EI. These findings indicate that the relationship between EI, subjective well-being and job performance may be dependent both on the overall levels of EI (high vs. low) and on the dimensionality of the sub-factors of EI within the different profiles. Therefore, although EI can be a learnt and trained human resource (Ruiz-Aranda et al., 2012), it is important to further consider the dimensionality of EI and between-person variations across dimensions when planning and implementing EI interventions in practice.

This study has some important limitations. The design of the study was cross-sectional and the results are correlative only, meaning that no causal interpretations can be made. Thus, the relationships found here need to be confirmed longitudinally. Furthermore, all the data were collected via self-reports, which may induce common method variance bias. Finally, the respondents were drawn from just one Asian country, Japan, and therefore it is unsure whether the results can be generalised to other Asian contexts. Nevertheless, our results confirm that the dimensionality of the sub-factors of EI within the different EI profiles is related to occupational well-being and performance in the Japanese context, which thus far has remained under-studied in EI research.

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II

ASSOCIATIONS OF TRAIT EMOTIONAL INTELLIGENCE WITH SOCIAL SUPPORT, WORK ENGAGEMENT, AND CREATIVITY IN JAPANESE ELDERCARE NURSES

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III

THE EFFECT OF TRAIT EMOTIONAL INTELLIGENCE ON PSYCHOPHYSIOLOGICAL STRESS RESPONSE INDUCED BY MENTAL STRESS TESTING

by

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The Effect of Trait Emotional Intelligence on Psychophysiological Stress Response Induced by Mental Stress Testing

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Abstract

The present study examined the relationship between trait emotional intelligence (EI) and psychophysiological stress response (HRV: HR, HF, LF/HF) to a mental stress test. We invited 28 healthy Japanese undergraduate university students (male: $n = 16$; female: $n = 12$; age = 21.0 ± 5.3 years) to the laboratory-based stress experiment, which comprised an anticipation period for 10 min, a task period for 10 min (a public speech task for 5 min and a mental arithmetic task for 5 min), and a recovery period for 30 min. Participants' EI was assessed with the Japanese version (translation) of the Wong and Law Emotional Intelligence Scale. The stress manipulation was successful, with all participants showing remarkable stress responses. The results revealed that individuals who scored higher on trait EI showed lower psychological stress and higher HF in the anticipation period than those who scored lower on trait EI. High trait EI individuals also displayed faster and better recovery of HF in the recovery period, although they exhibited the same high-stress response as their lower trait EI peers. Additional analysis revealed that regulation of emotion was the trait EI component that most strongly positively predicted the variance of HF in the anticipation and recovery periods. Overall, these results suggest that higher trait EI may be linked to a more adaptive profile of autonomic response in an acute stress condition compared to lower trait EI.

Keywords: Trait emotional intelligence, heart rate variability, psychological stress, psychophysiological stress, recovery

要旨

本研究では、特性情動知能 (EI) とメンタルストレスタスクに対する心理生理学的ストレス応答 (HRV : HR、HF、LF / HF) との関係を検討した。我々は、28 名の健康な日本人大学生 (男性 : $n = 16$ 、女性 : $n = 12$ 、年齢 = 21.0 ± 5.3 歳) を研究対象とし、10 分間の予測期、10 分間の課題期 (5 分間のパブリックスピーチタスク、5 分間の暗算課題)、および 30 分間の回復期からなる実験室ベースのストレス実験に招いた。研究対象者の特性 EI は、感情能力の 4 つの主要要素、すなわち自己の感情評価、他者の感情評価、感情の使用、感情の調節を評価する日本語版 Wong and Law Emotional Intelligence Scale を用いて測定した。分析の結果、本ストレス操作は研究参加者の顕著なストレス反応を誘引し、そのストレス源としての有効性を確認した。さらなる分析の結果、特性 EI の高い個人は、特性 EI の低い個人と比較して予測期における心理的ストレスが低く、HF が顕著に高いことが示された。加えて、高い特性 EI を有する個人は、課題期において特性 EI の低い個人と同水準のストレス反応を呈するものの、回復期においてより素早く良好な HF の回復を示すことが明らかとなった。これら予測期と回復期における HF を最も顕著に予測した特性 EI の下位因子は「感情の調節」であった。全体として本研究の結果は、高い特性 EI が、低い特性 EI に比べ、急性ストレス状況においてより適応的な自律神経反応動態と関連する可能性を示唆している。

キーワード: 特性情動知能, 心拍変動, 心理学的ストレス, 心理生理学的ストレス, リカバリー

INTRODUCTION

In modern Japanese society, management of well-being and health amid many sources of stress is an issue of growing importance (Kamide & Daibo, 2012). In this context, one central mission of research in well-being and health psychology is to identify personal resources that promote human functioning and flourishing (e.g., Tanaka, Togawa, & Sugita, 2010). Recently, emotional intelligence (EI) has attracted increasing research attention as the typical psychological resource (e.g., Kusaka, Chiba, & Sato, 2010).

Although EI has been diversely conceptualized thus far (Joseph & Newman, 2010), Mayer and Salovey (1997) first defined the construct as the cognitive ability “to monitor one’s own and others’ feelings and emotions, to discriminate among them, and to use this information to guide one’s thinking and action” (p. 10). In short, EI refers to the cognitive ability to process emotions and emotion-laden information which promotes well-being and adaptation (Salovey, Stroud, Woolery, & Epel, 2002). According to the four-branch model (Mayer & Salovey, 1997), EI is assumed to comprise four areas of problem-solving that are essential for processing emotions: perceiving emotions, using emotions to facilitate thought, understanding emotions, and managing emotions. *Perceiving emotions* indicates the ability to recognize feelings and emotions of the self and others accurately. *Using emotions to facilitate thought* represents the ability to generate moods and utilize that information to promote effective thoughts. *Understanding emotions* means the ability to label emotions and comprehend the transition of emotions. *Managing emotions* describes the ability to regulate emotions effectively to promote well-being and intellectual growth.

In contemporary research, two central conceptions of EI, based on the distinct measurement approach, have been identified: ability EI and trait EI (Joseph & Newman, 2010). Ability EI is measured with the maximum cognitive performance measure (Mayer & Salovey, 1997), which is akin to a general intelligence assessment. Trait EI is assessed with a typical performance test, such as self-report questionnaires (Toyota & Yamamoto). According to the specific operationalization, these conceptions represent heterogeneous entities; ability EI indicates the actual cognitive ability to reason about emotion whereas trait EI describes individuals’ perception of their emotional abilities. The focus of this study was on trait EI, an aggregation of emotional skills and competencies considered to be crucial for coping with various socio-emotional

stressors and adversities in daily life (Frank, 1988).

The Wong and Law Emotional Intelligence Scale (WLEIS; Wong & Law, 2002), which was developed in reference to Davies, Stankov, and Roberts (1998), is one of the self-report questionnaires widely used in EI research. This scale consists of 16 items that can be divided into four primary ability domains of EI: self-perception and expression of one's own emotions, perception and evaluation of others' emotions, using emotions to promote performance, and managing one's own emotions. Recently, the WLEIS was translated into Japanese and demonstrated excellent psychometric utility (Toyota & Yamamoto, 2011). The WLEIS comprises a relatively small number of items with satisfactory accuracy so that it can be used in various studies that require efficient assessment of trait EI (Toyota & Yamamoto, 2011). In the present study, participants' EI was assessed with the Japanese translation of the WLEIS.

A body of extant literature has shown that trait EI is related to human well-being and mental health. A study by Kalyoncu, Guney, Arslan, Guney, and Ayranci (2012) among medical nurses reported that higher trait EI was associated with more successful regulation of job stress. A study by Nakata (2006) among undergraduate students found that greater competence in regulating feelings and emotions was linked to fewer irrational responses, such as helplessness and problem avoidance. Likewise, Fukui and Sakano (2000) reported a cross-sectional study using a sample of university students, in which emotional management skills were identified as a particularly important element to avoid psychological malaise. Emotional competencies were also shown to be a positive predictor of life satisfaction (Extremera & Fernández-Berrocal, 2005), as well as personal success (Wong & Law, 2002). In contrast, research has suggested that poorer emotional ability is connected to risky cognitive and behavioral dispositions. For example, Brackett and Mayer (2003) indicated that lower EI might be a risk of higher neuroticism, a construct which is prone to adverse psychological outcomes such as loneliness, depression, and anxiety. Taken together, these findings suggest higher trait EI may lead to a greater sense of subjective well-being whereas lower trait EI may elicit emotional distress.

In contemporary health psychology research, the concept of allostasis has drawn increasing attention as an emerging psychobiological model of organismic adaptation to the environment. Allostasis refers to the process through which the organism copes with acute stress to maintain internal

stability through various physiological changes (McEwen, 2004). When facing stress events, the organism attempts to achieve adaptation by modulating autonomic, endocrinological, and immunological responses. However, if stress reactions are prolonged without sufficient recovery, these reactions can affect the internal stress systems (the autonomic nervous system [ANS] and the HPA [hypothalamic-pituitary-adrenal] axis), resulting in pathophysiological changes (McEwen, 2004).

In the process of allostasis, the ANS, which consists of the sympathetic nervous system and the parasympathetic nervous system, plays a central role in controlling stress reaction: i.e., the fight-or-flight response (McEwen, 2004). Research has demonstrated that the ANS mechanism is highly sensitive to a wide variety of stressors (e.g., Sawada, Tanaka, & Kato, 2006).

The activity of the ANS is typically reflected in heart rate variability (HRV). HRV is the fluctuation in heartbeats in a certain period of time (Fujinaga, 2003). In research, HRV is measured with electrocardiography, and the estimates are often processed with power spectral analysis (Sayers, 1973). This analysis is capable of identifying two primary constituents of HRV: high frequency and low frequency. High frequency (HF) is a peak power that exists in the frequency band from 0.15 to 0.40 and indicates parasympathetic cardiac control relating to the accumulation of energy and a state of relaxation (Fujinaga, 2003). Low frequency (LF) is a peak power which emerges in the frequency band from 0.01 to 0.15 Hz. This component represents a blend of sympathetic and parasympathetic activities (Fujinaga, 2003). In general, the ratio of LF to HF (LF/HF) is interpreted and used as an indicator of sympathetic activity (Yajima, Ikeda, & Kawano, 2012). In the present study, we used HRV for the indicator of autonomic activity.

To date, only limited studies have suggested a link between EI and physiological constructs. For example, Ciarrochi, Chan, and Caputi (2000) found that high capacity to manage emotions induces a greater sense of affective well-being, which is connected to healthy autonomic functioning (Kreibig, 2010). More directly, Salovey et al. (2002) examined the association between trait EI and physiological responses to a stress induction. They found that individuals with higher trait EI (the ability to discriminate between moods and the ability to attend to moods) showed fewer neurophysiological (systolic blood pressure) and neuroendocrinological (salivary cortisol) responses to stress challenges than those with lower EI. Also, Salovey and colleagues

observed that high trait EI individuals were likely to implement more adaptive coping methods, such as approaching stress positively and using an active coping style.

Present study

The preceding evidence suggests that trait EI may contribute to well-being not only at the psychological level but also at the physiological level, suggesting the promise of the construct as a personal resource for human functioning and flourishing. However, research on the physiological effect of trait EI is still scarce, and empirical evidence that links the construct to physiological well-being is limited. More problematically, no studies examining the physiological capacity of trait EI exist in Japan, to our knowledge. Thus, the present study addresses this issue by investigating the contribution of trait EI to physiological well-being under stress.

Specifically, the primary aim of this study was to examine the association between trait EI and autonomic response (HRV) to a laboratory-based stress induction. We formulated two hypotheses in light of earlier evidence that suggests the benefits of trait EI on subjective well-being (e.g., Kalyoncu et al., 2012) and physiological well-being (e.g., Kreibig, 2010; Salovey et al., 2002).

Hypothesis 1 (H1): Individuals who scored higher on trait EI will show lower autonomic (HRV) responses to a laboratory-based stress induction than those who scored lower on trait EI.

Hypothesis 2 (H2): Individuals who scored higher on trait EI will display better autonomic (HRV) recovery after stress loading than those who scored lower on trait EI.

Method

Participants

Based on the field-experimental study paradigm, we first recruited healthy Japanese undergraduate university students to participate in a questionnaire-based field survey where a measure of trait EI (the Japanese version of Wong and Law Emotional Intelligence Scale: J-WLEIS) was included. As a result, 446 (male: $n = 140$; female: $n = 306$; age = 20.0 ± 3.8) students gave full written informed consent and completed the field study. After excluding the unreliable samples (e.g., many with missing data), we categorized the participants into two groups with a mean of the score of the J-WLEIS: high trait EI group ($n = 219$) and low trait EI group ($n = 220$). Finally, we randomly selected 15 participants from each group and invited them to participate in a laboratory-based stress experiment. Except for two candidates from the high trait EI group, a total of 28 students (the high EI group: $n = 13$ [male = 7; female = 6; age = 21.4 ± 6.2 years]; the low EI group: $n = 15$ [male = 9; female = 6; age = 20.7 ± 4.5 years]) participated in the experimental study.

Procedure

This study was carried out according to the protocol of stress experiment established by Yajima (2012). The experiment was composed of three main periods: an anticipation period for 10 min, a task period for 10 min, and a recovery period for 30 min (see Figure 1). Before the experiment, participants were informed that they would experience several mental tasks in this study. Participants then rested quietly in room A for 10 min.

Next, participants were escorted to room B where two experimenters were waiting, seated and with a neutral facial expression. Following explanation of the experiment, participants were challenged with two kinds of mental stress tasks for 10 min: a public speech task for 5 min (task 1) and a mental arithmetic task for 5 min (task 2). After finishing the challenges, participants were guided to room A and rested for 30 min. We concluded the overall experiment by debriefing participants.

Regarding the measurement, participants scored their moods with the Japanese version of the Mood Adjective Check List: JUMACL) immediately after each period, and perceived stress (the Dundee Stress State Questionnaire: DSSQ) quickly after the anticipation period and the task period. HRV (HR, HF,

and LF/HF) was continuously measured throughout the experiment in a non-invasive way (see the section of measures).

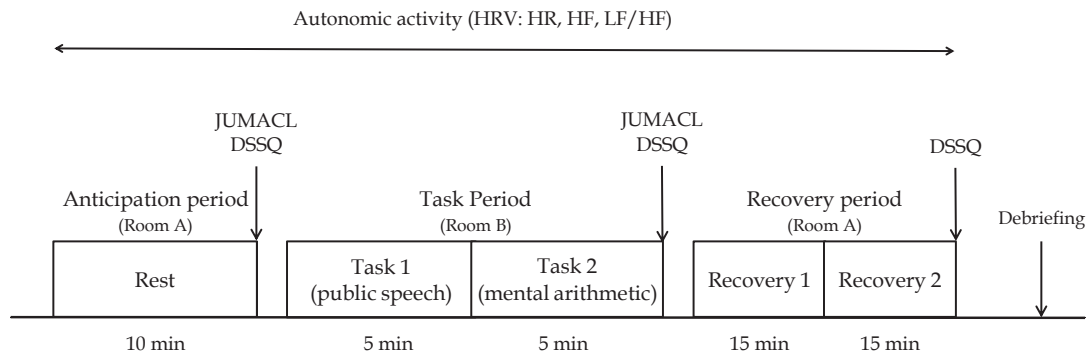


Figure 1. Experiment protocol

Mental stress tasks

1. Public speech task

Just before starting the tasks, participants were told that their challenge would be videotaped and the performance of the tasks would be evaluated by two experimenters in real time. For the public speech task, we prepared three topics: “Please introduce yourself in detail”; “Please speak about your future vision, concretely”; and “Please speak about your school life, precisely.” The topic for each speech was randomly chosen by the researchers on the spot. After thinking about the topic for 2 min, participants were asked to speak about the theme as concretely as possible for 3 min. Time allocations and remaining time of the task were not provided to participants to maximize the effect of the task. During the challenge, whenever participants stopped speaking or finished their speech in less than three minutes, the experimenter added pressure by saying “You still have time left to speak about the topic, please continue”. The task was completed when the researchers gave the signal “Stop speaking now”.

2. Mental arithmetic

Following the public speech task, the researchers immediately moved to a mental arithmetic task. In this challenge, participants were asked to subtract 13 from 2097 in succession as fast and accurate as possible for 5 min. However, if participants provided a wrong answer, they were required to redo the calculation from the beginning. As in the previous task, participants were not

informed of either the time allocation or the remaining time. Participants finished their task when signaled by the experimenters: "Stop speaking now".

Measures

Trait EI

The Japanese version of the Wong and Law Emotional Intelligence Scale (J-WLEIS; Toyota & Yamamoto, 2011) was used to assess participants' trait EI. This scale consists of 16 items in the four major ability domains of trait EI (four items for each domain): self-emotion appraisal (e.g., "I really understand what I feel"), others' emotion appraisal (e.g., "I am sensitive to the feelings and emotions of others"), use of emotion (e.g., "I would always encourage myself to try my best"), and regulation of emotion (e.g., "I have good control of my own emotions"). The items were scored on a 7-point scale from 1 (*totally disagree*) to 7 (*totally agree*).

Psychological stress

Moods were measured with the Japanese version of the UWIST Mood Adjective Checklist (JUMACL; Okamura, Tsuda, & Yajima, 2004). This scale comprises 20 items. Of these, ten items assess energetic arousal (e.g., "active," "vigorous"), and the others evaluate tense arousal (e.g., "anxious," "jittery"). The item responses use a 4-point scale from 1 (*definitely not*) to 4 (*definitely*).

Perceived stress was measured with 22 items of the DSSQ (Matthews et al., 2002; Matthews et al., 1999) to assess three stress state syndromes: task engagement, distress, and worry. Task engagement refers to energy, task motivation, and concentration. Distress represents tension, unpleasant mood, and lack of confidence. Worry includes self-focused attention, low self-esteem, and cognitive interference with the task and personal concerns. The items were scored on a 5-point scale ranging from 0 (*disagree*) to 4 (*agree*).

Autonomic activity

HRV was used as an indicator of autonomic activity. Participants' HRV was monitored by using LRR-03 (GMS Co., Ltd, Tokyo, Japan). This device performs frequency analyses of the R-R intervals of the electrocardiogram waveform, which are externally inputted from three electrodes attached to the left upper chest, the left abdomen, and the right abdomen. The data of HRV were then processed to identify HR, LF, and LF/HF by using TARAWA (GMS Co., Ltd,

Tokyo, Japan), which performs real-time power spectral analysis with the maximum entropy method (Yamada & Kataoka, 2006).

Statistical analysis

First, we tested the difference between the groups of trait EI in the scores of the WLEIS by using *t*-test. Second, one-way repeated ANOVAs and paired *t*-tests were performed on moods (energetic arousal and tense arousal) and perceived stress (task engagement, distress, and worry) to investigate the effectiveness of our mental stress tasks. We used a nonparametric test (the Mann–Whitney *U*-test) to examine the difference between the groups of trait EI in psychological stress (moods and perceived stress).

Regarding HRV, we calculated the mean of HR, HF and LF/HF in each time period and used these values for the following analyses. Two-way repeated measures of ANOVAs (trait EI × time) were performed to compare the groups of trait EI in the variation of HR, LF, and LF/HF. In cases where the data failed to satisfy with the assumption of Mauchly's test of sphericity, the degree of freedom was adjusted by the epsilon of Greenhouse–Geisser. Finally, an additional analysis with multiple regression analysis (the backward elimination method) was performed to examine the effect of components of trait EI on HF in each period of the experiment.

Statistical significance was defined as $p < .05$ and tendency to significance as $p < .10$. All analyses were performed using SPSS 21.0.

RESULTS

The scores of global trait EI ($t(26) = 7.12, p < .01$), self-emotion appraisal ($t(26) = 4.98, p < .01$), use of emotion ($t(26) = 7.00, p < .01$), and regulation of emotion ($t(26) = 2.60, p < .05$) were higher in the high trait EI group than those in the low trait EI group, although the difference between the groups of trait EI in others' emotion appraisal was non-significant ($t(26) = 1.57, p = ns$).

Table 1. Comparison between the EI groups of the scores of the J-WLEIS

	High EI group ($n = 13$)		Low EI group ($n = 15$)		t
	M	SD	M	SD	
EI	83.2	5.6	59.5	10.8	7.1 **
Self-emotion appraisal	24.2	2.8	16.9	4.5	5.0 **
Management of emotion	17.5	4.4	16.9	4.6	2.6 *
Use of emotion	21.8	3.2	12.2	3.9	7.0 **
Others' emotion appraisal	19.8	4.7	17.5	2.7	1.6

Note: * $p < .05$. ** $p < .01$.

Stress manipulation check

Participants showed a significant increase in tense arousal ($F(2, 83) = 10.18, p < .01$) and distress ($t(27) = 4.85, p < .01$) in response to the mental stress tasks. In addition, they showed a statistical tendency to increase task engagement from the anticipation period to the task period ($t(27) = 1.32, p < 0.1$). However, the variations in energy arousal ($F(2, 83) = 1.83, p = ns$) and worry ($t(27) = 1.32, p = ns$) were non-significant. Overall, these results indicate that the current stress manipulation was successful in eliciting remarkable psychological stress of the participants.

Table 2. Variation in psychological stress response to the stress induction

	Anticipation period		Test period		Recovery period	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Energy arousal	25.1	0.9	22.3	1.2	23.1	0.9
Tense arousal	21.2	1.1	25.7 *	1.2	19.0	0.9
Task engagement	18.3	0.6	19.5 #	0.5		
Distress	16.3	0.7	19.9 *	0.8		
Worry	14.4	0.5	13.5	0.6		

Note. # $p < 0.1$. * $p < .01$ (vs. anticipation period).

Comparison between the EI groups of psychological stress

The high trait EI group showed higher energy arousal than the low trait EI group in the anticipation period ($U = 23.50, p < .01$) and the recovery period ($U = 55.00, p < .05$). However, there was no significant difference during the mental stress tasks ($U = 70.50, p = ns$). Also, the high trait EI group displayed lower tense arousal in the anticipation period than the low trait EI group ($U = 162.00, p < .01$). However, the difference in the task period was non-significant ($U = 179.50, p = ns$). The high trait EI group also showed lower tense arousal in the recovery period ($U = 169.00, p < .01$).

Regarding perceived stress, the high trait EI group showed lower distress than the low trait EI group in the anticipation period ($U = 172.50, p < .01$). However, during the mental stress tasks, both groups showed the same degrees of distress ($U = 239.00, p = ns$). Task engagement in the anticipation period was higher in the high trait EI group compared to the low trait EI group ($U = 41.50, p < .01$). The high trait EI group also showed a statistical tendency to be higher in task engagement during the mental stress tasks ($U = 57.50, p < 0.1$) than the low trait EI group. In evaluating worry, there was no significant difference between the groups in either the anticipation period ($U = 63.00, p = ns$) or the task period ($U = 65.50, p = ns$).

Altogether, these results suggest that individuals who scored higher on trait EI are more likely than those who scored lower on trait EI to show lower psychological stress in the pre- and post-mental stress loading, as well as higher task engagement, before and during the stress challenges. However, there may be no significant difference between individuals with higher trait EI and lower trait EI in psychological stress during the mental stress tasks.

Table 3. Differences between groups of trait EI in psychological stress response

	High EI group (<i>n</i> = 13)		Low EI group (<i>n</i> = 15)		<i>U</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Energy arousal					
<i>Anticipation period</i>	20.2	5.8	9.6	2.4	23.5 **
<i>Test period</i>	16.6	7.9	12.7	4.1	<i>ns</i>
<i>Recovery period</i>	17.7	5.6	11.7	2.9	55.0 *
Tense arousal					
<i>Anticipation period</i>	9.5	4.1	18.8	5.2	162.0 **
<i>Test period</i>	13.1	7.3	15.7	5.5	<i>ns</i>
<i>Recovery period</i>	9.0	3.2	19.3	4.6	169.0 **
Task engagement					
<i>Anticipation period</i>	18.8	3.6	10.8	1.7	41.5 **
<i>Test period</i>	17.6	3.1	11.8	2.1	57.5 #
Distress					
<i>Anticipation period</i>	8.7	2.4	19.5	3.6	172.5 **
<i>Test period</i>	12.9	4.3	15.9	4.3	<i>ns</i>
Worry					
<i>Anticipation period</i>	17.2	2.4	12.2	3.0	<i>ns</i>
<i>Test period</i>	17.0	7.3	12.4	3.1	<i>ns</i>

Note: #*p* < 0.1. **p* < .05. ***p* < .01.

Comparison between the EI groups of autonomic activity

Regarding HR, a main effect of time was significant ($F(4, 104) = 138.20, p < .01, \eta_p^2 = .842$). However, a main effect of trait EI ($F(1, 26) = 0.54, p = ns, \eta_p^2 = .020$) and an interaction effect of trait EI and time ($F(4, 104) = 1.65, p = ns, \eta_p^2 = .060$) were non-significant. A pairwise comparison with Bonferroni adjustment revealed, in both groups of trait EI, that HR significantly increased in response to task 1 ($p < .01$) and task 2 ($p < .01$), and then returned to the baseline level in recovery 1 ($p < .01$ [vs. the task period]) and recovery 2 ($p < .01$ [vs. the task period]).

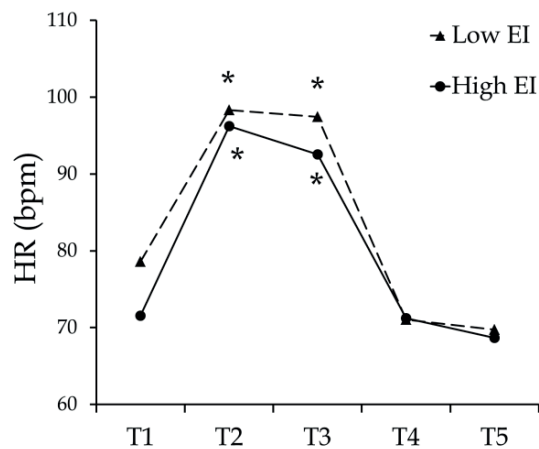


Figure 2. Difference between the groups of trait EI in HR

Note: T1 = anticipation period; T2 = task 1 (public speech task); T3 = task 2 (mental arithmetic task); T4 = recovery 1; T5 = recovery 2.

* $p < .01$ (vs. T1).

Regarding HF, a main effect of time ($F(4, 104) = 35.90, p < .01, \eta_p^2 = .580$) was significant, and a main effect of trait EI showed a tendency to significance ($F(1, 26) = 3.89, p < 0.1, \eta_p^2 = .130$). Moreover, an interaction effect of trait EI and time was significant ($F(4, 104) = 4.36, p < .05, \eta_p^2 = .144$). A post-hoc test revealed that the high trait EI group showed higher HF than the low trait EI group in the anticipation period ($p < .01$) and in recovery 1 ($p < .01$). In addition, HF in the high trait EI group displayed a significant decrease in response to task 1 ($p < .01$) and task 2 ($p < .01$), which subsequently bounced back to the baseline level in recovery 1 ($p < .01$ [vs. task period]) and recovery 2 ($p < .01$ [vs. task period]). In contrast, HF in the low trait EI group showed a non-significant variation in response to the stress loading because of its high baseline level. After the stress session, HF barely increased in recovery 2 ($p < .01$ [vs. task period]).

These results indicate that individuals who scored higher on trait EI are likely to show higher parasympathetic activity in the pre- and post-mental stress testing than those rated lower on trait EI. However, during the task period, both high- and low-trait EI individuals may show a low level of parasympathetic activity, and the level of parasympathetic activity in both individuals may be of the same degree. Also, individuals with higher trait EI is

likely to appear display higher parasympathetic reactivity to stress stimulus.

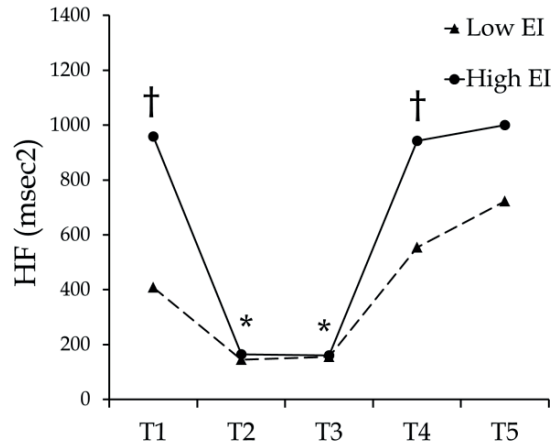


Figure 3. Difference between the groups of trait EI in HF

Note: T1 = anticipation period; T2 = task 1 (public speech task); T3 = task 2 (mental arithmetic task); T4 = recovery 1; T5 = recovery 2.

* $p < .01$ (high EI; vs. T1), † $p < .01$ (vs. low EI).

With respect to LF/HF, a main effect of time was significant ($F(4, 104) = 80.10, p < .01, \eta_p^2 = .755$). However, neither a main effect of EI ($F(1, 26) = 0.38, p = ns, \eta_p^2 = .015$) nor an interaction effect of EI and time ($F(4, 104) = 0.84, p = ns, \eta_p^2 = .031$) were significant. In both groups of trait EI, a pairwise comparison with Bonferroni adjustment revealed that LF/HF significantly increased during task 1 ($p < .01$) and task 2 ($p < .01$), after which it returned to the baseline level in recovery 1 ($p < .01$ [vs. task period]) and recovery 2 ($p < .01$ [vs. task period]).

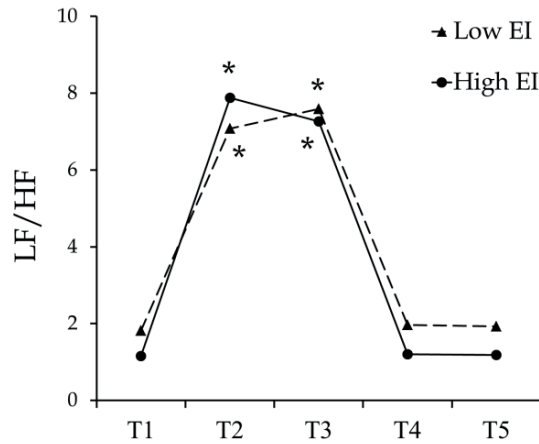


Figure 4. Difference between the groups of trait EI in LF/HF

Note: T1 = anticipation period; T2 = task 1 (public speech task); T3 = task 2 (mental arithmetic task); T4 = recovery 1; T5 = recovery 2.

* $p < .01$ (vs. T1).

Additional analysis

The regression analyses revealed that regulation of emotion ($\beta = 0.37, p < .05$) and others' emotion appraisal ($\beta = 0.34, p < .05$) positively predicted HF in the anticipation period. Moreover, regulation of emotion had a positive impact on HF in recovery 1 ($\beta = 0.45, p < .05$) and recovery 2 ($\beta = 0.37, p < .05$).

Table 4. Multiple regression analysis of sub-factors of EI in predicting HF

Time	Components of EI	R^2	β
Anticipation period	Regulation of emotion	.29	.37 *
	Others' emotion appraisal		.34 *
Task period			
<i>Task 1</i>			
<i>Task 2</i>			
Recovery period			
<i>Recovery 1</i>	Regulation of emotion	.21	.45 *
<i>Recovery 2</i>	Regulation of emotion	.14	.37 *

Note: * $p < .05$.

Discussion

The primary purpose of this study was to examine the association between trait EI and psychophysiological response (HRV) to a laboratory-based stress loading. Preliminary analysis showed that stress manipulation using the public speech task and the mental arithmetic task was successful, with participants displaying a significant increase in psychological stress. A similar result was found by Yajima (2002), in which the same method of stress induction was used. Thus, the observation suggests the validity of the present stress experiment. Previous studies have suggested that trait EI promotes subjective well-being (e.g., Matthews et al., 2006), and the affirmative act may become more evident when conspicuous stress exists (e.g., Kalyoncu et al., 2012). The present study provides evidence to add to these findings by demonstrating the adaptive capacity of trait EI to manage psychological and physiological response to acute stress. We discuss the main findings below in more detail.

Trait EI and psychological response

We found that individuals who scored higher on trait EI presented more positive mood (higher energy arousal, lower tense arousal) and less perceived stress (higher task engagement, and lower distress) in the anticipation period. These results suggest that high trait EI people may experience less psychological stress in a situation that is potentially distressing due to the anticipation of stress. A possible reason for this could be that people high in emotional skills and competencies may be likely to interpret stressful situations more positively. Salovey et al. (2002) found that persons with higher perceived emotional ability were likely to implement more adaptive and positive coping strategies when stressed, such as viewing the stress situation as a challenge but not a threat, and actively addressing sources of stress.

However, we observed that individuals who scored higher on trait EI displayed a high level of psychological stress in response to the stress loading, similar to the stress levels of those who scored lower on trait EI. This result is in line with Ciarrochi et al. (2000), who found that high emotional capacity did not serve as a buffer against negative mood in a stress condition. One reason for this could be a greater ability to perceive internal affective experience in high trait EI individuals (Goldman, Kraemer, & Salovey, 1996). By enhancing the sensitivity to stress events, this ability may instead elicit remarkable

psychological stress in the face of acute stress (Goldman et al., 1996).

Nevertheless, in the recovery period, we found that individuals with higher trait EI showed a better psychological state (energy arousal and lower tense arousal) than their lower trait EI counterparts. This result suggests that, despite the higher response to the stress stimulus, persons with higher emotional capacity are likely to achieve better affective well-being after a stressful experience, a finding which reconciles with Ciarrochi et al. (2000), who showed the excellent capacity of trait EI to maintain positive mood in an emotional situation. One reason for this could be the disposition of high trait EI persons to use more active coping skills in a stress situation (Salovey et al., 2002). It is important to recall that, in the present study, individuals with higher trait EI showed higher engagement in the stress tasks.

Trait EI and autonomic response

We found that participants showed an upsurge in HRV (HR, HF, and LF/HF) in response to the current stress induction, adding to the potential of the current mental tasks as a stressor. Earlier analogous studies reported a similar reaction of HRV to a laboratory-based stress induction (e.g., Hayashi et al., 2008; Yajima, 2002).

We detected a significant interaction effect of trait EI and time on HF, but not on the other components of HRV (i.e., HR, LF/HF). The results revealed that individuals who scored higher on trait EI showed higher HF in the anticipation period than those with lower trait EI. This finding indicates that parasympathetic activity in the baseline phase was higher in individuals with higher trait EI than their lower trait EI peers. In previous studies, it was shown that parasympathetic nerves are highly sensitive, even to weak stressors (Mukai et al., 1992) and thus reflect emotional distress with high accuracy (Hayano, 1994; Ishida, Okada, & Bando, 2004). In general, reduction of parasympathetic activity indicates the activation or predominance of negative emotions (Igawa et al., 2010). For example, Hayashi et al. (2007) found that individuals characterized by high anxiety showed significant parasympathetic recession compared to those marked by low anxiety. Likewise, an experimental stress study by Yajima, Ogata, and Kawano (2010) reported that participants presented a remarkable reduction in parasympathetic activity along with the activation of negative mood induced by a psychosocial stress loading. In contrast, it has been suggested that the increase of parasympathetic activity is

related to the state of being relaxed and a positive emotional state. A stress experiment by Yajima et al. (2010), for instance, found that the increase of parasympathetic activity following stress was positively predicted by activation of positive mood. Given these findings, our results can be interpreted to mean that individuals with higher trait EI experienced less emotional conflict in anticipation of the mental stress tasks, a finding consistent with their psychological stress response in the baseline phase. As discussed previously, this could be attributed to the higher tendency of high trait EI people to use more positive coping in a stress situation (Salovey et al., 2002).

Contradictory to our H1, however, we found that trait EI did not differentiate the level of physiological stress response during the task period. Specifically, individuals who scored higher on trait EI showed parasympathetic diminution to the same degree as those who scored lower on trait EI, a result that is comparable with their psychological stress during the stress loading. Moreover, individuals with higher trait EI displayed higher parasympathetic reactivity to the mental stress testing. These results indicate that, during the task period, stress levels in individuals with higher trait EI were as high as their lower trait EI peers. This finding lends support for Goldman et al. (1996), who found that higher trait EI was related to a more significant reporting of psychological distress in a stress condition. Thus, it seems that high perceived emotional capacity does not always lead to beneficial consequences.

Notwithstanding this finding, we observed that, in the recovery period (15 min after the stress challenge), individuals who scored higher on trait EI showed higher HF than those who scored lower on trait EI, thereby supporting H2. This result indicates that persons with higher trait EI could have quicker and better recovery from stressful experiences, despite their high-stress response to the stress stimulus. This finding provides support for the view of Tugade and Fredrickson (2002) that emotionally intelligent individuals are compatible with resilient people. Individuals who develop excellent emotional skills and competencies are likely to maintain and make use of positive emotions to alleviate the effect of negative emotional experiences. As demonstrated in earlier studies, positive emotions serve to promote the healthy patterns of autonomic activity (Herbert & Choen, 1993; Kreibig, 2010) and recovery capacity of the organism (Block & Kremen, 1996; Dockray & Steptoe, 2010; Tugade & Fredrickson, 2002).

Additional analysis revealed that regulation of emotion was the component

of trait EI which most strongly and positively predicted parasympathetic activity in the anticipation period and the recovery period. These results lend support for Davies et al. (1998), who view regulation of emotion as a key factor for the preservation of positive mood in the stress situation. Also, it adds to the suggestion of Ramos, Fernández-Berrocal, and Extremera (2007) that the ability to manage emotions is of vital importance in down-regulating negative mood and achieving successful adaptation.

Conclusion

The present study demonstrates the adaptive capacity of trait EI in acute stress regulation. The results suggest that high trait EI people are less likely to experience psychosomatic stress in a potentially demanding situation. This finding reconciles with earlier laboratory-based experimental studies that link higher emotional ability to adaptive coping (e.g., Salovey et al., 2002). In addition, the results revealed that, in a remarkable response to the stress stimulus, individuals having higher trait EI displayed a significant increase in HF in the early phase of the recovery period (15 min after the stress loading), indicating that higher trait EI may lead to faster and better autonomic recovery following stress. This finding is consistent with previous studies showing that persons with higher ability to manage emotions displayed better autonomic regulation following exposure to stress events (Appelhans & Luecken, 2006; Gross, 1998; Salovey et al., 2002). Also, it adds to Tugade and Frederickson (2002), who suggested that emotionally intelligent people tend to use positive emotions efficiently in stressful circumstances and, by doing so, achieve resiliency. Thus, higher trait EI seems to be related to a more adaptive profile of psychophysiological response in acute stress conditions.

In contrast, individuals with lower trait EI showed a remarkable suppression of parasympathetic tone in the baseline phase, and it was retained during the stress challenges. Consequently, their parasympathetic activity displayed its null variation over these periods (for a supplement, see Berntson, Cacioppo, Quigley, & Fabro, 1994). A similar phenomenon was reported in Hayashi et al. (2008), in which parasympathetic activity in individuals having high anxiety did not show, due to the high baseline level, a significant decrease in response to the negative mood induction. Also, our results revealed that

these individuals exhibited relatively slower and poorer parasympathetic recovery. This finding adds to previous studies suggesting that lower emotional ability is related to less controllability of negative mood following adverse emotional experiences (e.g., Ciarrochi, Deane, & Anderson, 2002; Salovey, 2001). Since the prolonged activation of negative mood after facing a stressor can predispose individuals to maladaptive physiological functioning (Waugh, Panage, Mendes, & Gotlib, 2010), lower trait EI individuals might be more likely to experience health impairment in the long run.

Limitation and Future direction

This study has several limitations. First, the sample size was small, and the only participants were undergraduate university students. Therefore, one should be careful to generalize the present findings to other populations. Also, the stress loading was conducted with the participants one by one in a laboratory, so the situation differed from a naturalistic condition (i.e., our actual daily life). Thus, the ecological validity of this study is questioned. Research implemented in the context of a laboratory might be able to partially address this issue by utilizing the TSST-Group (von Dawans, Kirschbaum, & Heinrichs, 2011) which enables investigation of the stress reaction of individuals in a situation where multiple participants are included. In addition, it might also be effective to load a variety of stressors on participants in a serial manner, as in everyday life. Of note, in a recent experimental study, it was found that stress may be accumulated along with the repeated stressors (Nomura, Mizuno, Nozawa, Asano, & Ide, 2009). Thus, future research should explore a more advanced experiment protocol by incorporating these perspectives and making efforts to increase understanding of trait EI's physiological capacity.

Finally, we discuss an issue to be addressed in future physiological EI studies. The steady growth of evidence suggesting the benefits of EI in human wellness has stimulated attempts to enhance emotional abilities (Nozaki, 2012). To date, several studies have demonstrated the effectiveness of EI training to promote human functioning and well-being (e.g., Caruso & Salovey, 2004; Kusaka et al., 2010; Slaski & Cartwright, 2003), and these findings highlight the substantial value of exploring the benefits of the construct. Nevertheless, it should be noted that, since trait EI is a multi-dimensional construct, its

adaptability may also be determined by the profile (proportion) of the components. Thus, it could be that not only adaptive but also maladaptive EI training exists. Indeed, Fernández-Berrocal and Extremera (2006) reported an experimental study suggesting that a combination of high ability to distinguish moods and low ability to repair moods is related to poor psychological recovery from stress. Analogously, other several studies showed that the high ability to attend to moods in tandem with the poor capacity to understand and manage emotions is connected to the scanty capacity of recovery (Gohm, 2003; Gohm & Clore, 2002; Lieschetzke & Eid, 2003). In light of these findings, it could be speculated that there also are physiologically beneficial and risky trait EI profiles. However, to our knowledge, there is no direct evidence so far. Thus, before the practical application of EI training, taxonomic studies on trait EI addressing this gap are necessary.

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IV

TRAIT EMOTIONAL INTELLIGENCE, SELF-REPORTED AFFECT, AND SALIVARY ALPHA-AMYLASE ON WORKING DAYS AND A NON-WORKING DAY

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