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Research Article

The Yin-Yang personality from biopsychological perspective using revised Sasang Personality Questionnaire

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ABSTRACT

Background: The biopsychological, pathological and physical characteristics of Yin-Yang (Eum-Yang in Korean) have been suggested using Sasang Personality Questionnaire (SPQ), however, the revision of SPQ is required for escalating its clinical use and multidimensional study on Yin-Yang.
Methods: 274 university students were recruited to complete the SPQ, candidate items of revised SPQ (rSPQ) along with the Temperament and Character Inventory (TCI). After selecting rSPQ items using Item Analysis and Explorative Factor Analysis, its psychometric property was examined using Confirmatory Factor Analysis, Pearson's correlation and *t*-test. The biopsychological features of Yin and Yang personality groups based on rSPQ total score were illustrated with the TCI using ANOVA and Profile Analysis.
Results: The behavior, cognition and emotion subscales of 15-item rSPQ had robust psychometric construct and showed distinctive psychological characteristics of Yin-Yang. The rSPQ-total score was correlated positively with SPQ-total ($r = 0.644$, $p < 0.01$) and TCI Novelty-Seeking ($r = 0.398$, $p < 0.01$), and negatively with TCI Harm-Avoidance ($r = -0.364$, $p < 0.01$). And, the Yin personality group (34.45 ± 10.36 and 46.82 ± 12.27) has significantly different scores in Novelty-Seeking and Harm-Avoidance compared to Yang personality group (43.2 ± 9.1 and 36.53 ± 10.78). Yin and Yang personality groups showed distinctive TCI subscale profiles as shown in previous studies.
Conclusion: The current study showed the organized subscale structure and clinical validity of rSPQ for Yin-Yang personality, and it would provide foundation for East-West cross-cultural psychology and integrative medicine.

1. Introduction

The Yin-Yang (Eum-Yang in Korean) has been a pivotal theory of East-Asian philosophy, sociology, psychology, science, technology and medicine for thousands of years.[1] However, since the harsh modernization of the 19th century, it has been undervalued as an ambiguous and abstract concept without substantial entities.[2,3] Interest for the Yin-Yang theory from a scientific perspective has been scarce due to the lack of research methodologies and experiences for analyzing East-Asian principles, and difficulties associated with scrutinizing the operational definition of Yin-Yang in diverse fields.[2]

However, the clinical efficacy of traditional East-Asian medicine using acupuncture and medical herbs has been substantiated, and the biopsychosocial perspective of Yin-Yang is gradually gaining attention.[4–6] Although previous studies have regarded the Yin-Yang as philosophical, religious and socio-cultural,[7,8] recent biological studies consider the Yin-Yang as a dynamic equilibrium of physiological functions,[5,6] e.g., oxidation and anti-oxidation,[9] pro-inflammation and anti-inflammation, and blood coagulation.[10]

The Yin-Yang denotes opposite and complementary qualities or matters,[2,11] such as night-day, dark-light, inside-outside, introvert-extrovert, passive-active, stable-dynamic, aloof-sociable and others.[1,8,12] The Sasang Personality Questionnaire (SPQ), a clinical measure for the Yin-Yang psychobiology with three dimensions of behavior, cognition and emotion, has been developed based on the previous traditional East-Asian medicine studies.[2,13] It has been applied in various research areas studying biopsychological,

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physical, and pathological characteristics, along with disease susceptibility and treatment response of Yin-Yang personality.[14,15]

The biopsychological definition of Yang was suggested as 'the approach to novel stimuli which can be intensified by rewards', and that of Yin as 'the active shift to an opposite direction regardless of emotional instability'.[2,16] The individuals with Yang personality (high SPQ total score) are shown to be extroverted, sociable, flexible, carefree, irritable and emotional, and those with Yin personality (low SPQ total score) are introverted, inhibited, consistent, thoughtful, calm and stable with previous studies.[17,18] The detailed biopsychological characteristics of Yin and Yang in behavioral, cognitive and emotional perspectives acquired from previous studies are presented in Table 1.

The Yang and Yin have been shown to have theoretical and clinical similarity with Behavior Activation System (BAS) and Behavior Inhibition System (BIS) of Gray and Novelty-Seeking (NS) and Harm-Avoidance (HA) of Cloninger in Western psychology using SPQ.[2,19,20] The Yang personality was known to be related to NS of Temperament and Character Inventory (TCI) and Extraversion of NEO-Personality Inventory (NEO-PI), and the Yin personality to HA of TCI.[13]

From the psychopathological perspective, the Yang personality was reported to be correlated to externalizing problems and the Yin personality to internalizing problems of Achenbach System of Empirically Based Assessment (ASEBA).[21,22] The Yang behavior (high SPQ-Behavior score) was found to be a protective factor of behavior problems, and the Yang emotion (high SPQ-Emotion score) a risk factor in middle and high school students.[21,22] In clinical patients, the Yin behavior (low SPQ-Behavior score) is reported to be associated with Major Depression Disorder, and the Yang emotion with Functional Dyspepsia and Major Depression Disorder.[23] From the physical perspective, the Yang personality has seems to have high muscle volume and power[24] while the relations between Yin-Yang personality and physical features of Body Mass Index (weight/height^2) or Ponderal Index (weight/height^3) were found to be not statistically significant or independent.[25]

Although the SPQ has repeatedly shown its clinical usefulness, there were certain concerns that need to be resolved. First, the current question items force the respondents to choose either one of two words or features describing themselves,[13] thereby challenging them to select the best-fit answer, depending on their understanding the content of the question. Therefore, the format of questionnaire needs to be revised to measure the degree of agreement to the content of question items, such as the Likert scale.

Second, adolescents may have difficulty in recognizing and responding to some SPQ items,[26] and gender differences in SPQ-Cognition subscale have also been reported.[12,27–29] For example, content of certain questions, such as "Do you consider yourself feminine or masculine?" and "Do you tend to be relatively direct or indirect when expressing yourself", might have different connotations, depending on the gender, age and cultural background of the individuals. Thus, it requires rectification for easy and correct understandings.

Third, the stability and construct validity of the three SPQ subscales need to be improved. The internal consistency of SPQ subscales was reported to be low, and several SPQ items were loaded on different factors in some cases.[26] Thus, the question items should be amended so that the operational definition of SPQ subscales would be stated more clearly and consistently.

Therefore, the aim of the present study was to develop the revised SPQ (rSPQ) with acceptable psychometric features representing the structured definition of Yin-Yang (Table 1), and to illustrate the biopsychological characteristics of Yin-Yang and its three domains in university students using the TCI. And, the differences of TCI subscale scores and TCI subscale profiles between Yin and Yang personality groups based on the rSPQ scores were further examined using Analysis of Variance (ANOVA) and Profile Analysis to reveal the distinctive TCI subscale features of Yin and Yang personality groups. The data from the current study might indicate whether the rSPQ is well-defined psychobiological instrument of the Yin-Yang personality with high validity and reliability.

The Yin-Yang theory is the most important theoretical foundation of traditional East-Asian science and medicine,[1] and the rSPQ is an clinical instrument for analyzing biopsychological characteristics of Yin-Yang and its behavioral, cognitive and emotional dimensions (Table 1). With further studies, it would be useful for easier and comprehensive understanding on medical theories and clinical findings of the East, increased utilization of acupuncture and medical herbs in the West, and cross-cultural study on the East and West integrative psychology and medicine in the future.

2. Method

2.1. Procedures and participants

The initial item pool was established by the authors; 30 candidate items for the rSPQ were extracted through preliminary (n = 6) and pilot (n = 50) studies for item selection and modification. A total of 280 (> 5 times the number of candidate items) Korean university students volunteered to participate were recruited for the current study, and their informed written consents were acquired in advance. The TCI and the SPQ along with candidate items of rSPQ were administered to the participants. The psychological features of Yin and Yang personality groups were illustrated with TCI after examining the psychometric properties of devised rSPQ. The current study was performed under the recognition of institutional IRB board (KSU-18-01-002).

2.2. Development of the rSPQ

The candidate item pool of rSPQ was developed with the reference to the Table 1 by two authors (HC and SL), having prior experience and knowledge of traditional medicine, clinical psychology, and medical perspectives of Yin-Yang and its subdomains.[17,19]

Total of 75 candidate items (19, 23 and 22 items for behavior, cognition and emotion subscales, respectively) using a 4-point Likert scale (0 = not at all, 1 = not, 2 = true and 3 = very true) were developed to substantiate the operational definition of the Yin-Yang personality (Table 1). A preliminary study using 6 participants with distinctive Yin or Yang personalities was performed to delete items without clear differences, and to modify items showing trivial variances for Yin-Yang personality.

The pilot study enrolled 50 university students and examined 68 candidate items (23, 23 and 22 items for behavior, cognition and emotion subscales, respectively) selected from the preliminary study. The items showing acceptable psychometric characteristics (Table 1) of previous Yin-Yang personality studies with SPQ,[2,19] (e.g., positive correlation with NEO-PI Extraversion and TCI NS, negative correlation with TCI HA, and high score in So-Yang Sasang type group and low score in So-Eum Sasang type group diagnosed using Questionnaire for Sasang Constitution Classification II) were selected to be candidate items (10 items each for behavior, cognition and emotion subscales) of rSPQ.

The Item Analysis was used to extract acceptable items from the 30 candidate items. The Explorative Factor Analysis using Principal axis extraction and Kaiser normalization with Varimax rotation were used. The number of factor structure was determined considering theoretical interpretation, conceptual coherence, scree plot, and Eigen value and cumulative variance in factor loading matrix. The items with extreme means, too small standard deviation, item total correlation lesser than 0.3, item-item correlation greater than

Table 1
Biopsychological characteristics of Yin-Yang personality and its three sub-dimensions in regard to SPQ and other measures.

	Yin (Eum, low SPQ score) group	Yang (Yang, high SPQ score) group
Overall	Introverted, cautious, reserved, inhibited, consistent, organized, calm and stable person. SPQ-total was correlated positively with Novelty-Seeking (TCI), Extraversion (NEO-PI), Behavior Activation System (BIS/BAS scale), Positive Affect (PANAS) and internalizing problem behaviors (ASEBA) and negatively with Harm-Avoidance (TCI) and externalizing problem behaviors (ASEBA). SPQ-total has no significant correlation with physical features of Body Mass Index and Ponderal Index. SPQ-total score of So-Yang, Tae-Eum and So-Eum Sasang types are in decreasing order.	Extroverted, sociable, carefree, quick, excited, flexible, irritable and emotional person.
Behavioral domain	Introverted, asocial, independent, inactive, slow, passive and inhibited behavioral attitude. SPQ-Behavior was correlated positively with Vitality (SF12), Positive Affect (PANAS), adaptive cognitive emotion regulation (CERQ), and negatively with total problem behaviors (ASEBA).	Extroverted, sociable, cooperative, pro-active, industrious and energetic behavioral attitude.
Cognitive domain	Meticulous, narrow focused, pessimistic, reflective, consistent, rigid, cautious, considerate and organized cognitive style SPQ-Cognition subscale was correlated negatively with problem behaviors (ASEBA).	Easy-going, with broad view, optimistic, confident, liberated, straightforward, flexible and carefree cognitive style
Emotional domain	Static, stable, calm, serene, placid, unexcited, detached, reserved, rational and unemotional response. SPQ-Emotion subscale was correlated positively with Negative Affect (PANAS), maladaptive cognitive emotion regulation (CERQ), and total problem behaviors (ASEBA). Vulnerable to psychopathology.	Affective, unstable, irritable, enthusiastic, intolerant, sympathetic, dynamic, irrational and emotional response.

Sasang Personality Questionnaire, SPQ; Temperament and Character Inventory, TCI; NEO Personality Inventory, NEO-PI; Positive Affect and Negative Affect Schedule, PANAS; Cognitive Emotion Regulation Questionnaire, CERQ; Behavior Inhibition and Activation scale, BIS/BAS scale; Achenbach System of Empirically Based Assessment, ASEBA; Short-Form 12, SF-12.

0.6, small item information function in Item Response Theory, factor loading smaller than 0.35, small loading difference, cross-loading in two factors, and factor loaded in unexpected factor were carefully chosen for elimination, and 5 items were finally selected for the rSPQ three subscales of behavior, cognition and emotion, respectively.

2.3. Psychological measures

The SPQ measures biopsychological features of the Yin-Yang personality; it comprises three subscales (Table 1) of behavior (e.g., passive vs. active), cognition (e.g., meticulous vs. easy-going) and emotion (e.g., static vs. dynamic).[2,13] The SPQ has 15 self-report items requiring the respondents to choose one of three answers for each question item to describe themselves (e.g., for the query "Do you consider yourself meticulous or easy-going?" the choices are 1 = meticulous, 2 = not sure, 3 = easy-going).[2,13]

The SPQ encompasses two opposite ends of the Yin-Yang personality dimension, and a lower SPQ score is considered as stronger Yin personality whereas a higher SPQ score indicates a stronger Yang personality.[2] The previous study with university students reported that the internal consistency for SPQ total, SPQ-Behavior, SPQ-Cognition and SPQ-Emotion were 0.772, 0.769, 0.581, and 0.641, respectively.[11]

The TCI is a biopsychological personality theory of Cloninger[30] with two-interrelated dimensions: the temperament, which measures the involuntary processes or biases in automatic responses to emotional stimuli, and the character, which reflects differences in higher cognitive functions associated with values and goals of a person.[2,31,32]

The temperament dimension has four subscales that include NS, HA, Reward-Dependence (RD) and Persistence (PS). The NS and HA are based on the Gray's biopsychological theory of BAS and BIS, respectively. The NS is related with exploratory excitability in response to novel stimuli, and the HA relates to the behavioral inhibition in response to abhorrent or dangerous stimuli.[33] The character dimension is reported to be related to psychological health and well-being, and has three subscales of Self-Directedness (SD), Cooperativeness (CO), and Self-Transcendence (ST).[30–32]

The Korean version of the TCI is a 140-item self-report questionnaire asking individuals to score each item on a 5-point scale (0 = not at all to 4=very true). The Cronbach's alpha for the NS, HA, RD, PS, SD, CO and ST subscales were 0.829, 0.857, 0.814, 0.821, 0.865, 0.758 and 0.899, respectively.[34]

2.4. Statistical analysis

For analyzing the demographic features, χ^2 was applied for school grade distribution, and *t*-test for comparing the age of male and female students.

The Confirmatory Factor Analysis (CFA) was used to examine the construct validity of the 15-item rSPQ. As for the model fit index, χ^2, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standard Root Mean Residual (SRMR) were used, and the structural equation model is considered as acceptable when the p-value of χ^2 is less than 0.05, CFI is greater than 0.9, TLS is greater than 0.95, RMSEA is less than 0.08, and SRMR is less than 0.08. The internal consistency of rSPQ and its subscales of behavior, cognition and emotion were examined with Cronbach's alpha as a test reliability.

The *t*-test was used to compare differences of TCI subscales, SPQ and rSPQ between male and female students, and Pearson's correlation was used to examine the psychological structure as concurrent and convergence validity of rSPQ, which showed correlation coefficient among subscales of rSPQ, SPQ and TCI.

Psychological features of Yin and Yang personality groups based on rSPQ total score were examined.[2] First, we assigned the Yang (top 30% of rSPQ total score) and Yin (bottom 30% of rSPQ total score) personality groups based on the order of rSPQ total score of each subject, and remaining subjects (middle 40%) were allocated as the uncertain group, as shown in previous study.[2] Second, the ANOVA for rSPQ and TCI subscales examined the differences between Yang, uncertain, and Yin personality groups, and Bonferroni or Dunnett's T3 were used for the post-hoc analysis, depending

Table 2
Demographic features of the participants in current study.

	Male	Female	Total	
N (%)	95 (34.7)	179 (65.3)	274	
Age*	20.6 ± 2.39	19.12 ± 1.06	19.64 ± 1.78	t = 5.743, p < 0.001
grade				χ^2 = 4.322, p = 0.229
1st	28	54	82	
2nd	49	104	153	
3rd	6	11	17	
4th	12	10	22	

* p < 0.001.

on the significance of Levene's homogeneity test. Third, Profile Analysis was used to examine significant differences in rSPQ and TCI subscale profiles among the Yin, uncertain, and Yang personality groups, and Greenhouse-Geisser correction was used with the significance of Mauchly's sphericity test.

The data were presented as mean ± standard deviation or frequency (percentage). All statistical analyses were performed using the IBM SPSS Statistics 25.0 (IBM, Armonk, NY) and MPlus 5.21 (Muthen & Muthen, Los Angeles, CA),[35] and p values of 0.05, 0.01, and 0.001 were used for assessing significance.

3. Results

3.1. Demographic features of the participants

The data of 274 participants, who completed the TCI and SPQ along with 30 candidate rSPQ items, were used for the statistical analysis. Demographic features of the participants in current study are presented in Table 2. No significant difference (χ^2 = 4.322, p = 0.229) was observed in the grade distribution between male and female; however, the age of the male subjects (20.60 ± 2.39 years) was significantly higher (t = 5.743, p < 0.001) than that of female subjects (19.64 ± 1.78 years).

3.2. Construct validity of rSPQ and its subscales

The CFA was implemented to examine the construct validity of the 15-item rSPQ (Table 3), and the modified three factor model showed an acceptable model fit index (χ^2 = 231.709 (p < 0.001), CFI = 0.909, TLI = 0.888, RMSEA = 0.098, SRMR = 0.069). Values of factor loading in the current study might be practically meaningful, considering the result that the standardized factor loading of 13 items was higher than 0.5 (Table 3).

The correlations among extracted factors were examined, and three factors were well distinguished (Table 3). Significance was observed only between rSPQ-Cognition and rSPQ-Emotion (r = 0.292, p < 0.001). The internal consistency of rSPQ-total, rSPQ-Behavior, rSPQ-Cognition, and rSPQ-Emotion were 0.704, 0.861, 0.685, and 0.709, respectively.

In contrast, the internal consistency of the old SPQ-total, SPQ-Behavior, SPQ-Cognition, and SPQ-Emotion as determined in the current study were 0.699, 0.752, 0.467, and 0.631, respectively. The Cronbach's alpha of SPQ-Cognition was lesser as compared to that of rSPQ-Cognition (α = 0.685). The CFA on the SPQ demonstrated that the number of items loaded on SPQ-Behavior, SPQ-Cognition and SPQ-Emotion subscales were 8, 3, and 4, respectively.

3.3. Demographic characteristics of TCI, SPQ and rSPQ subscales

The TCI, SPQ and rSPQ subscale scores of male and female in the current study are presented in Table 4. Female students (43.24 ± 11.14, 22.93 ± 9.79, 5.69 ± 2.24, and 7.51 ± 2.57) showed significantly higher scores than male students (38.69 ± 12.99, 20.36 ± 9.89, 4.29 ± 2.42, and 6.44 ± 2.78) for HA, ST, SPQ-Emotion, and rSPQ-Emotion, respectively. However, the SD score of female students (42.65 ± 10.45) was significantly lower than male students (46.02 ± 11.26) (Table 4).

The gender difference in cognition and emotion subscales were decreased in the rSPQ as compared to the SPQ. The rSPQ (t = 0.400, p = 0.689 and t = −3.187, p < 0.01) showed less distinctive gender differences than the SPQ (t = 1.910, p = 0.057 and t = −4.757, p < 0.001) for cognition and emotion subscales, respectively. Furthermore, the gender difference of rSPQ-Emotion (t = −3.187, p < 0.01) might be case sensitive, since it stemmed from gender differences of HA (t = −3.032, p < 0.01), SD (t = 2.474, p < 0.05), and ST (t = −2.061, p < 0.05), for the current study participants (Table 4).

3.4. Correlation coefficient among subscales of rSPQ, SPQ and TCI

The correlation analysis was performed to examine the psychological structure of three subscales of the rSPQ. The correlation coefficients among rSPQ subscales and between subscales of rSPQ, SPQ and TCI were as shown in Table 5. And, the correlations among SPQ subscales and between subscales of rSPQ and SPQ were also examined to appraise the improvements of the rSPQ compared to the SPQ. The rSPQ-total score significantly correlated with rSPQ-Behavior (r = 0.668, p < 0.001), rSPQ-Cognition (r = 0.477, p < 0.001) and rSPQ-Emotion (0.668, p < 0.001) but no significant correlations were observed between the three rSPQ subscale scores with correlation coefficients from -0.063 to 0.111 (Table 5).

However, the SPQ-total score significantly correlated with SPQ-Behavior (r = 0.762, p < 0.001), SPQ-Cognition (r = 0.640, p < 0.001) and SPQ-Emotion (r = 0.652, p < 0.001), and the SPQ-Behavior showed significant correlations with SPQ-Cognition (r = 0.310, p < 0.001) and SPQ-Emotion (r = 0.206, p < 0.01) (Supplementary Table 1). Furthermore, the SPQ and the rSPQ were significantly correlated with respect to total score (r = 0.644, p < 0.001), behavior (r = 0.666, p < 0.001), cognition (r = 0.346, p < 0.001), and emotion (r = 0.602, p < 0.001) subscales.

The correlation analysis between subscales of rSPQ and TCI showed that the rSPQ-total score significantly correlated with NS (r = 0.398, p < 0.001), HA (r = −0.364, p < 0.001), and RD (r = 0.265, p < 0.001), as presented in Table 5. Considering that the SPQ-total score was significantly correlated with NS (r = 0.422, p < 0.001), HA (r = −0.282, p < 0.001), and RD (r = 0.409, p < 0.001), our results indicate that the rSPQ has a similar psychological structure as the SPQ. However, the significant correlations of SPQ-total score with PS (r = 0.244, p < 0.001) and SD (r = 0.157, p < 0.05) were not observed with the rSPQ.

3.5. Subscales and subscale profiles of TCI, SPQ and rSPQ in Yin and Yang personality groups

The clinical features of Yin-Yang personality based on the rSPQ were examined with TCI subscales. A total of 265 participants were divided into Yin, Yang and uncertain personality groups based on the rSPQ total score: Yang (rSPQ-total score≥24, n = 83 (31.3%)), Yin (rSPQ-total score≤18, n = 84 (31.7%)), and uncertain (19 ≤ rSPQ-total score≤23, n = 98 (37.0%)). There were no significant differences in sex (χ^2 = 0.396, p = 0.820) and age (F = 0.112, df = 262, p = 0.894) among the three personality groups. The differences in subscales and subscale profiles of rSPQ, SPQ and TCI for the Yin, Yang and uncertain personality groups were examined with ANOVA and Profile Analysis, as shown in Fig. 1.

There were significant differences in rSPQ-total (F = 519.15, df = 262, p < 0.001), rSPQ-Behavior (F = 74.96, df = 262, p < 0.001), rSPQ-Cognition (F = 28.15, df = 262, p < 0.001), and rSPQ-Emotion (F = 71.94, df = 262, p < 0.001) with ANOVA, and the post-hoc analy-

Table 3
Factor loading of rSPQ items and inter-correlations among estimated rSPQ factors using Confirmative Factor Analysis.

Subscale and items	Unstandardized factor loading	Standard Error	Standardized factor loading
rSPQ-Behavior			
Do not speak to others at first	1.000	–	0.792
Be active in strange situations	1.025	0.074	0.811
Be comfortable with strangers	1.044	0.085	0.732
Be a proactive person	0.918	0.079	0.707
Be sociable	0.934	0.074	0.739
rSPQ-Cognition			
Act after considering surroundings	1.000	–	0.636
Observe circumstances meticulously	0.937	0.145	0.503
Have many worries than others	0.785	0.173	0.353
Think about results before acting	1.426	0.180	0.734
Consider things before making decisions	1.010	0.144	0.599
rSPQ-Emotion			
Others say that I am impatient	1.000	–	0.649
Be often moody	0.981	0.154	0.564
Get angry and relieved easily	0.619	0.141	0.370
Be often agitated	0.835	0.136	0.548
Get easily excited over trifles	0.979	0.146	0.600
	rSPQ-Behavior	rSPQ-Cognition	rSPQ-Emotion
rSPQ-Behavior	1		
rSPQ-Cognition	−0.104	1	
rSPQ-Emotion	0.145	.292*	1

rSPQ, revised Sasang Personality Questionnaire.
* $p < 0.001$.

Table 4
SPQ, rSPQ and TCI subscale scores of male and female.

	Male	Female	Total	t-test
TCI				
NS	38.98 ± 9.12	38.37 ± 10.48	38.58 ± 10.02	t = 0.479, p = 0.632
HA**	38.69 ± 12.99	43.24 ± 11.14	41.66 ± 11.99	t = −3.032, p < 0.01
RD	48.31 ± 10.91	49.32 ± 9.77	48.97 ± 10.17	t = −0.789, p = 0.431
PS	42.89 ± 11.44	40.46 ± 11.08	41.31 ± 11.24	t = 1.709, p = 0.089
SD*	46.02 ± 11.26	42.65 ± 10.45	43.82 ± 10.84	t = 2.474, p < 0.05
CO	59.32 ± 10.14	57.78 ± 9.51	58.31 ± 9.75	t = 1.246, p = 0.214
ST*	20.36 ± 9.89	22.93 ± 9.79	22.04 ± 9.88	t = −2.061, p < 0.05
SPQ-Total	15.53 ± 4.62	16.59 ± 4.92	16.21 ± 4.83	t = −1.708, p = 0.089
SPQ-Behavior	5.98 ± 2.65	6.21 ± 2.45	6.13 ± 2.52	t = −0.718, p = 0.474
SPQ-Cognition	5.22 ± 1.91	4.71 ± 2.19	4.89 ± 2.10	t = 1.910, p = 0.057
SPQ-Emotion***	4.29 ± 2.42	5.69 ± 2.24	5.20 ± 2.40	t = −4.757, p < 0.001
rSPQ-Total	20.37 ± 4.58	21.15 ± 5.20	20.89 ± 5.00	t = −1.215, p = 0.226
rSPQ-Behavior	8.34 ± 3.20	8.03 ± 3.16	8.14 ± 3.17	t = 0.765, p = 0.445
rSPQ-Cognition	5.69 ± 2.22	5.57 ± 2.33	5.61 ± 2.29	t = 0.400, p = 0.689
rSPQ-Emotion**	6.44 ± 2.78	7.51 ± 2.57	7.14 ± 2.69	t = −3.187, p < 0.01

NS, Novelty-Seeking; HA, Harm-Avoidance; RD, Reward-Dependence; PS, Persistence; SD, Self-Directedness; CO, Cooperativeness; ST, Self-Transcendence; Sasang Personality Questionnaire, SPQ; revised Sasang Personality Questionnaire, rSPQ.
*p < 0.05; **, p < 0.01; ***, p < 0.001.

Table 5
Correlation coefficients between subscales of rSPQ and TCI.

	rSPQ			TCI						
	rSPQ-Behavior	rSPQ-Cognition	rSPQ-Emotion	NS	HA	RD	PS	SD	CO	ST
rSPQ-Total	**.668*** **	**.477*** **	**.668*** **	**.398*** **	**−.364*** **	.265***	.055	.040	−.142*	.030
rSPQ-Behavior		−.063	.111	.172**	**−.585*** **	.436***	**.430*** **	**.359*** **	.246***	.036
rSPQ-Cognition			.109	.215***	−.222***	−.212***	**−.327*** **	−.005	−.264***	−.142*
rSPQ-Emotion				**.363*** **	.198**	.162**	−.122*	**−.330*** **	−.295***	.129*

Bold represents bigger than 0.3.
revised Sasang Personality Questionnaire, rSPQ; TCI, Temperament and Character Inventory; NS, Novelty-Seeking; HA, Harm-Avoidance; RD, Reward-Dependence; PS, Persistence; SD, Self-Directedness; CO, Cooperativeness; ST, Self-Transcendence;
*, p < 0.05; **, p < 0.01; ***, p < 0.001.

sis attested significant differences among Yin, Yang, and uncertain personality groups in rSPQ-total, rSPQ-Behavior, rSPQ-Cognition and rSPQ-Emotion (Fig. 1**-A**). Interestingly, significant differences were also observed in SPQ-total ($F = 71.48$, $df = 254$, $p < 0.001$), SPQ-Behavior ($F = 34.84$, $df = 254$, $p < 0.001$), SPQ-Cognition ($F = 35.53$, $df = 254$, $p < 0.001$), and SPQ-Emotion ($F = 13.41$, $df = 254$, $p < 0.001$) among the Yin, Yang and uncertain personality groups with ANOVA. The post-hoc analysis attested significant differences among Yin, Yang and uncertain groups in SPQ-total, SPQ-Behavior and SPQ-Cognition. And the Yang group was significantly higher than the Yin and uncertain groups in SPQ-Emotion subscale. Summarizing the results of both rSPQ and SPQ, we found that the rSPQ was compatible with the SPQ, and hence the application of rSPQ for analyzing Yin-Yang personality is acceptable.

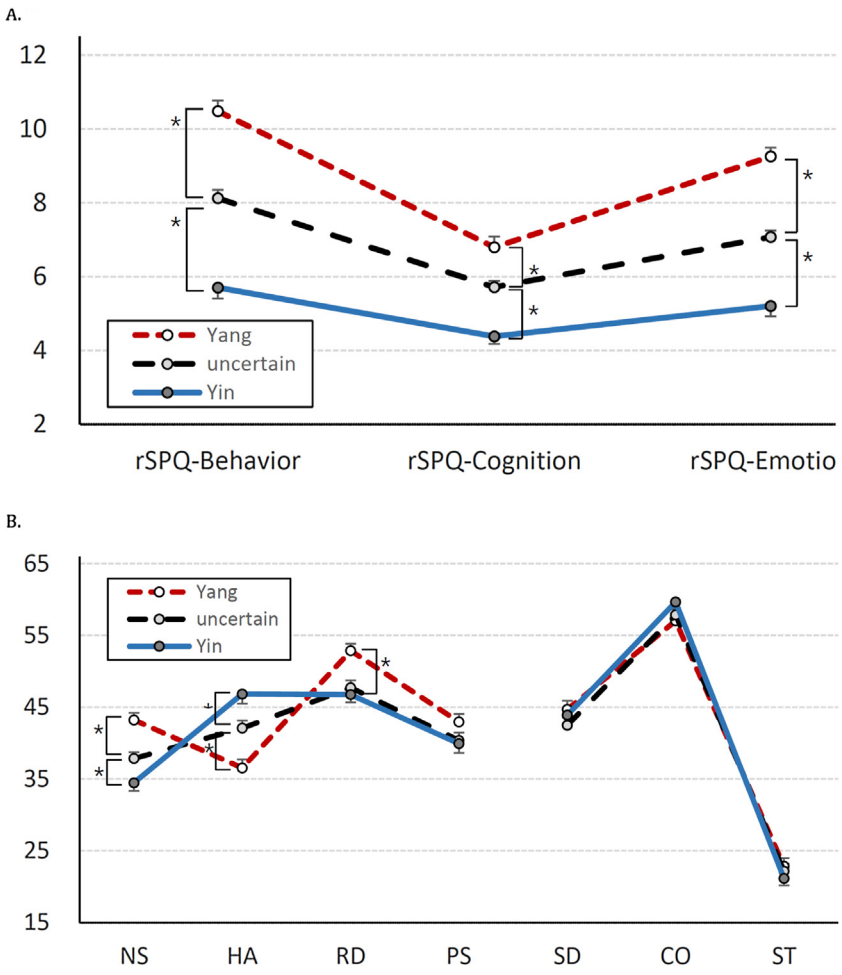

Fig. 1. rSPQ and TCI subscale profile of Yin, uncertain and Yang personality groups based on rSPQ total score.

Profile Analysis was applied to examine the significant differences in rSPQ subscale profiles among the Yin, Yang and uncertain personality groups (Fig. 1**-A**), and Greenhouse-Geisser correction was used for the significance ($p < 0.01$) of Mauchly's test of Sphericity. The SPQ subscale profile of the three personality groups was not flat (Greenhouse-Geisser correction, $F = 59.66$, $df = 1.915$, $p < 0.001$), and interaction of the three personality groups was significantly different as for parallelism (Greenhouse-Geisser correction, $F = 4.54$, $df = 3.829$, $p < 0.001$). These results indicate that the SPQ subscale profiles of Yin, Yang and uncertain groups significantly differed from each other.

As for the TCI, significant differences were observed for NS ($F = 18.47$, $df = 262$, $p < 0.001$), HA ($F = 17.71$, $df = 262$, $p < 0.001$) and RD ($F = 9.45$, $df = 262$, $p < 0.001$) among the Yin, Yang and uncertain personality groups with ANOVA. The post-hoc analysis subsequently verified significant differences among Yin, Yang, and uncertain groups in NS and HA. And the Yang group was higher than Yin and uncertain groups in RD (Fig. 1**-B**).

Profile Analysis was also applied to examine significant differences in TCI subscale profiles among the Yin, uncertain and Yang personality groups (Fig. 1**-B**), and the Greenhouse-Geisser correction was used for the significance ($p < 0.001$) of Mauchly's test of Sphericity. The TCI subscale profile of the three personality groups was not flat (Greenhouse-Geisser correction, $F = 316.86$, $df = 3.916$, $p < 0.001$), and the interaction of the three personality groups was significantly different as for parallelism (Greenhouse-Geisser correction, $F = 8.26$, $df = 7.832$, $p < 0.001$), indicating that the TCI subscale profiles of Yin, Yang and uncertain groups were significantly distinctive from each other.

4. Discussion

This study developed the rSPQ with three robust subscales and a 4-point Likert scale, and provided organized definition and representative description of Yin-Yang personality using TCI and its subscales. The rSPQ has an acceptable model fit index, improved internal consistency, and decreased gender difference demonstrating its construct validity (Table 4 and 5). Furthermore, the Yin and Yang personality groups showed distinctive TCI subscales and TCI subscale profiles substantiating psychological features of Yin-Yang (Fig. 1).

The current study endeavored to devise new question items with high stability and reliability for the psychological measure of Yin-Yang, and following improvements of rSPQ were acquired successfully. First, the contents of the questionnaire were revised so that personal value, gender and sociocultural background might not influence the responses. The format of items was also changed to measure the degree of agreement on a single dimension using the 4-point Likert scale. The items of SPQ[13] that were difficult to be understood by adolescents ("Do you have a delicate or tough personality"), could be influenced by personal value or judgement ("Do you tend to act hastily or meticulously"), and might be opinionated by gender ("Do you consider yourself feminine or masculine") were excluded in the current rSPQ. With respect to the gender differences (Table 4), the decreased gender difference was found

in the rSPQ-Cognition ($t = 0.400$, $p = 0.689$) when compared to the SPQ-Cognition ($t = 1.910$, $p = 0.057$). Furthermore, the magnitude of gender difference in the rSPQ-Emotion ($t = -3.187$) is lesser than the SPQ-Emotion ($t = -4.757$), resulting in the improved validity of the instrument.

Besides, the HA ($t = -3.032$), SD ($t = 2.474$) and ST ($t = -2.061$) scores of the current study were found to be gender dependent (Table 4), and these psychological characteristics of current participants[11,13,30] might influence the gender differences observed in both SPQ-Emotion and rSPQ-Emotion (Table 5).

Second, the stability and construct validity of rSPQ were improved compared to the SPQ (Table 3). The internal consistency of SPQ-total, SPQ-Behavior, SPQ-Cognition and SPQ-Emotion were 0.699, 0.752, 0.467 and 0.631, respectively, whereas values of the rSPQ-total, rSPQ-Behavior, rSPQ-Cognition and rSPQ-Emotion were shown to be 0.704, 0.861, 0.685 and 0.709, respectively; these results reveal an improvement of stability of the rSPQ, especially in cognition subscale. The confirmatory factor loading of the SPQ items were compared with the rSPQ, and the numbers of loaded items were 8, 3 and 4 for SPQ-Behavior, SPQ-Cognition and SPQ-Emotion, respectively, contradicting to the high construct validity of the rSPQ in current study.

Third, the revision in the current study provided the operational definition of Yin-Yang personality clearly and distinctively by lowering the correlation coefficient among the three rSPQ subscales (Table 3). Previous studies using the SPQ showed significant correlations between SPQ-Behavior and SPQ-Cognition in preschoolers,[28] elementary students,[27,28] middle school students,[26,36] high school students[12,29] and university students,[11,13] as well as adults[13] showing correlation coefficient ranged from 0.256 to 0.541. However, the current study showed no significant correlation coefficient between rSPQ-Behavior and rSPQ-Emotion subscales (Table 3), and no significant correlations ($r = -0.063 \sim 0.111$) among the three rSPQ subscales (Table 5).

Personality might be defined as manner of activity or expression (behavior) associated with affective state and its changes (emotion) that stem from the outcome of one's appraisal, evaluation and decision (cognition) regarding a specific situation and event. And, there are numerous reports correlating physical and psychological health, well-being and longevity in the West and East.[30,37]

The current study suggested a more defined and organized psychological characterization of Yin-Yang personality and its subdomains by considering the behavioral, cognitive and emotional perspectives (Table 1). Based on the correlations with TCI subscales (Table 5), the description of three domains of Yin-Yang or three subscales of rSPQ, along with repeatedly reported associations with Novelty-Seeking and Harm-Avoidance,[2,11–13,19,20,26–29,36] would be as follows (Table 1). The rSPQ-Behavior was observed to significantly correlate with RD ($r = 0.436$, $p < 0.01$), PS ($r = 0.430$, $p < 0.01$), SD ($r = 0.359$, $p < 0.01$) and CO ($r = 0.246$, $p < 0.01$), indicating that those with high rSPQ-Behavior are cooperative, sociable, persistent and proactive.[30] The rSPQ-Cognition was correlated with RD ($r = -0.212$, $p < 0.01$), PS ($r = -0.327$ $p < 0.01$), CO ($r = -0.264$ $p < 0.01$) and ST ($r = -0.142$ $p < 0.05$), meaning that those with high rSPQ-Cognition are straight forward, independent, self-centered, flexible, negotiable and easy-going. The rSPQ-Emotion were associated with RD ($r = 0.162$, $p < 0.01$), PS ($r = -0.122$, $p < 0.05$), SD ($r = -0.330$, $p < 0.01$), CO ($r = -0.295$, $p < 0.01$) and ST ($r = 0.129$, $p < 0.05$), implying that those with high rSPQ-Emotion are sympathetic, irritable, unstable, hostile and irrational.[30,32,34]

In addition, we found that SD and CO positively correlate with rSPQ-Behavior and negatively with rSPQ-Emotion (Table 5), These results might conclude that rSPQ-Behavior and rSPQ-Emotion subscales would be protective and risk factors, respectively, for psychological and physical well-being since the rSPQ-Behavior was correlated positively with SD and negatively with HA, and the rSPQ-Emotion demonstrated the opposite (Table 5). The combination of low SD and high HA scores was known to be related to academic stress, personality disorders and other mental disorders.[17,30,37–39] When we put these associations together, the Yin-Yang (Eum-Yang) theory corresponds well to Western notions of temperament[2,19,20] and the balance and health[21,40] of personality depends on integrative learning processes designated as character in the West.[41–43]

The Yin-Yang has long been used as a medical theory for explaining the physical, psychological, physiological and pathological features along with treatment schema in East Asia for thousand years. It has been suggested that deficiency of heat, vitality and energy might be ameliorated with the Yin personality (low rSPQ total or high HA and low NS score, introverts) group-specific medical herbs of *Ginseng Radix*, *Atractylodis Rhizoma* Alba, *Glycyrrhizae Radix*, *Cinnamomi Cortex*, *Citri Pericarpium*, *Zingiberis Rhizoma* Crudus, with stomachic, spasmolytic, sedative and anti-inflammatory effects to help digestive dysfunction and stress- and anxiety-related responses.[14,27] Hyper-activated bodily functions might be controlled with the Yang personality (high rSPQ total or high NS and low HA score, extroverts) group-specific medical herbs of *Rehmanniae Radix*, *Corni Fructus*, Hoeoen, *Alismatis Rhizoma*, *Osterici Radix*, and *Angelicae Pubescentis* Radix, with antipyretic, Radix, with antipyretic.[14,27] Simultaneously, an acupuncture stimuli of HT7 (+), SP3 (+) and LI4 (-) are recommended for the Yin personality group, and of HT3 (+), KI3 (+) and SP3 (-) for the Yang personality group to restore the balance of Yin-Yang and autonomic reactivity.[14]

The current study has the following limitations, which need to be addressed in future studies. First, studies on test-retest reliability with short and long intervals[11,26] and demographic features of rSPQ using various age groups,[11–13,26–29,36,44] are required for the generalization. There is also a need for study on the gender differences in other participants especially adolescents, and the differences between patients and healthy subjects[27,28] are need to be examined.

Second, the correlation studies between Yin-Yang personality and Western measures are needed using the rSPQ. There have been studies on psychological characteristics of Yin-Yang using NEO-PI,[13] BIS/BAS scale, Cognitive Emotion Regulation Questionnaire,[17] ASEBA,[22] Positive Affect and Negative Affect Schedule[45] and Short Form-12,[46] anxiety related measures of State and Trait Anxiety Inventory and Symptom Checklist-90, physiological characteristics of Body Mass Index,[47] Ponderal Index,[25] muscle power and physical fitness,[24] and clinical disease of depression and functional dyspepsia.[23]

Last but not the least, the generalizability of Yin-Yang personality should be examined with cross-cultural studies. Clarification of operational definition and improvement of validity in the current study might be employed with foreign participants, e.g., Latinos, African Americans, Middle Easterners and Caucasians, to examine whether the Yin-Yang personality is universal and compatible.[20]

In conclusion, this study provided the objective and well-organized psychological characteristics of Yin-Yang and its subdomains of behavior, cognition and emotion using 15-item rSPQ. The rSPQ has improved psychometrics and correlations with TCI subscales to provide a short and efficient measure of Yang personality (top 30% of rSPQ) and Yin personality (bottom 30% of rSPQ) groups. These would provide foundations for expanding the use of the Yin-Yang theory to multi-disciplinary and cross-cultural studies, and promote the use of thousands-year old East-Asian wisdoms and techniques for mental and physical health of the current generation.

Author contributions

HC and SJL: Conceptualization, Methodology, Investigation. HC, YIC, and SJL: Fornal Analysis, Writing - original draft. HC, YIC, and SJL: Writing - review & editing.

Conflict of interest

The authors declare no conflict of interest.

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None.

Ethical statement

This study was performed under the recognition of institutional IRB board (KSU-18-01-002). Informed written consents of the participants were acquired in advance.

Data availability

Data will be made available upon request.

Appendix A. Supplementary material

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.imr.2020.100455.

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