

## The Moderating Effect of Emotion Regulation on the Relationship between Neuroticism and Sleep Quality

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### ABSTRACT

Personality, especially neuroticism has been found related to be related with poor sleep quality. This study focused on emotion regulation, reappraisal and suppression, which can buffer or aggravate the effect of neuroticism influencing sleep quality. One hundred and forty two ordinary adults were used in this study and were recruited and required to complete a package of questionnaires including: the Eysenck personality Questionnaire/EPQ, the Emotion Regulation Questionnaire/ERQ, and the Pittsburgh Sleep Quality Index/PSQI. The result was that participants with higher neuroticism had poorer sleep qualities than those with lower neuroticism. Moreover, participants that had high neuroticism and high reappraisal had better sleep qualities. This means that there was an interaction effect of neuroticism and reappraisal on sleep quality. However, suppression did not have a moderating effect on the relation between neuroticism and sleep quality. These findings inferred that reappraisal plays an important moderating role (buffering effect) on the relationship between neuroticism and sleep quality. Reappraisal cannot only prevent people high in neuroticism from sleep problems but can also buffer symptoms of sleep disorder by treating patient's negative emotions.

**Key words:** Neuroticism, Sleep Quality, Reappraisal, Suppression.

### 1. INTRODUCTION

People have poor sleep quality means he or she may have sleep disturbances, which have been found to relate to a wide range of health problems and diseases. Insomnia is a more serious and prevalent condition of poor sleep quality, which is often defined as a complaint of poor or unsatisfactory sleep [1]. Korea was the worst in sleep deficiency in OECD [2]. Moreover difficulty in sleep maintenance is the most prevalent symptom of insomnia in Korean [3].

Neuroticism, as a fundamental personality trait, is an enduring tendency to experience negative emotional states. Individuals who are high in neuroticism are more likely to experience feelings such as anxiety, anger, guilt, and depressed mood [4]. Eysenck [5] also argued that the personality dimension of neuroticism relates to individual differences in excitability and emotional responsiveness, which are reflected in autonomic activation. The close relation between neuroticism and negative emotions such as anxiety or tense has also been suggested as an important cause for difficulty in falling sleep and other sleep disturbances [6]. One well-

established finding from precedent researches was that poor sleep quality is related to neuroticism in clinical populations [7], [8]. Gray and Watson [9] indicated that individuals both high in neuroticism and negative emotionality reported lower overall sleep quality, and have correlations with subjective sleep inefficiency and high scores of Pittsburgh Sleep Quality Index (PSQI). Soehner, Kennedy and Monk [10] also demonstrated that individual high in neuroticism was associated with worse subjective sleep and reported more unwanted wakefulness after sleep onset. Similar results also have been found that short sleep (defined as  $\leq 6$  hours of sleep per 24-hour period) had a significant and positive association with neuroticism [11]-[13]. As mentioned above, high neuroticism might be a risk factor for poor sleep quality. However it does not mean that all individuals high in neuroticism suffer from poor sleep qualities.

Emotion regulation, defined as a capability to regulate subject's emotion, has three core features to focus [14]. First, people may regulate either negative or positive emotions, either by decreasing them or by increasing them. Second, emotion regulation may be a conscious, effortful, and controlled regulation or unconscious, effortless, and automatic regulation. There are behavioral [15], [16] and physiological approaches that show possibility in teaching automatic emotion regulation processes [17]-[19]. Third, it is improper to make a priori assumption that whether any particular form of emotion regulation is necessarily good or bad [20]. Reappraisal as an

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adaptive cognitive emotion regulation refers to thinking about an emotional stimulus or situation in a way which can decrease emotional intensity [21]. One literature provided clear evidences that reappraisal of stimuli before full activation of emotion has salutary effect on the later manifestation of negative emotion [22]. In a clinical setting, it has also been shown that patients with specific phobias who were instructed to reappraise their core threats experienced greater symptom reduction than those receiving exposure exercise without reappraisal. Gross and Thompson [14] also endorsed that use of cognitive reappraisal for emotion regulation, particular in advance of emotion-provoking situations or before emotions have reached a peak level of intensity. In addition, reappraisal has been related to reduce subjective negative emotion without sympathetic arousal [22], [23]. Moreover, it has been suggested that habitual use of adaptive emotion regulation strategies to manage emotions was associated with high positive affect and low negative affect, and also with positive interpersonal function and well-being [24]. Therefore it's reasonable to assume that reappraisal, as a positive emotion regulation, may buffer the link between neuroticism and sleep quality through decreasing sympathetic arousal (e.g., anxiety) caused by neuroticism.

Suppression, as a maladaptive emotion regulation strategy, has been defined to try to hide what one is feeling. Evidences have shown that individuals who are instructed to use suppression are successful in decreasing expressive behavior, and decreasing the subjective experience of positive emotion but not negative emotion [22], [23]. Despite decreasing arousal is the goal of effort to regulate many negative emotions (e.g., anxiety, anger), suppression is consistently associated with increased sympathetic arousal. Recent researches have suggested that maladaptive emotion regulation strategies are related to anxiety and mood disorder [25], [26]. As described, neuroticism is highly related to negative emotions such as anxiety, therefore the close relation between maladaptive emotion regulation and negative emotions or mood disorder may aggravate neuroticism.

Based on evidences presented before, reappraisal has been suggested that can decrease negative emotions pretending sympathetic arousal to buffer poor sleep quality against neuroticism related negative emotions [22], [23]. Nevertheless, if individuals high in neuroticism use suppression frequently, it may increase the risk of suffering from sleep disturbances. Otherwise, there has been little research on the role of emotion regulation playing on the relation between neuroticism and sleep quality yet. Therefore, the purpose of this study is to examine whether reappraisal or suppression moderates the relationship between neuroticism and sleep quality. The hypothesis was that reappraisal buffers the link between neuroticism and sleep quality but suppression worsens the link.

## 2. METHOD

### 2.1 Participant

Total 189 participants were recruited by a snowball sampling, in which we ask colleagues, friends, families, and friends of families about study participation. After an

agreement of participation in oral, they were asked to complete a package of questionnaires, which consists a brief explanation of this study with a sigh to agree on study participation, Eysenck personality Questionnaire, Emotion Regulation Questionnaire, and Pittsburgh Sleep Quality Index. Participants reside Seoul and Gyeonggi-do Province. However, 47 samples were excluded because of missing data or incomplete data. In final, there were 142 samples' data were analyzed, and 52 were males and 90 were females. They ranged in age from 20 to 63 years old ( $M=35.42$  years,  $SD=9.687$ ).

### 2.2 Instruments

**2.2.1 Eysenck Personality Questionnaire (EPQ):** EPQ is a self-report questionnaire developed by Eysenck and Eysenck [4]. It is used to measure 4 major traits: psychoticism/P, extraversion-introversion/E, neuroticism/N and lie/L. Neuroticism related 26 items of Korean version of EPQ used in present study was developed by Eysenck and Lee [27] and it showed a high inter-item consistency (Cronbach's = .89).

**2.2.2 Emotion Regulation Questionnaire (ERQ):** ERQ is a 10-item self-report scale to measure person's emotion regulation, which contains two parts: reappraisal with 6 items and suppression with 4 items. Higher overall scores indicate more using of reappraisal or suppression [24]. The Korean version of ERQ developed by Shon [28] was used in this study and the inter-item consistency was both high in reappraisal (Cronbach's = .91) and suppression (Cronbach's = .79).

**2.2.3 Pittsburgh Sleep Quality Index (PSQI):** PSQI developed by Buysse, Reynolds, Monk, Berman and Kupfer [29] is a reliable, valid, and standardized measure of sleep quality. The PSQI consists of 19 self-reported items and 5 items rated by the bed partner or roommate. The latter five items are used for clinical information only, are not tabulated in the scoring of the PSQI. The Korean version of PSQI was translated by Kim, Han and Park [30], which consists of 19 items grouped into 7 component scores (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction), each weighted equally on a 0-3 scale. The 7 component scores can be summed to yield a global PSQI score ranged from 0 to 21. Higher score indicates poor sleep quality. If PSQI global score is higher than 5, it indicates that a subject is having severe difficulties in at least two areas, or moderate difficulties in more than three areas. The PSQI used in present study showed a high inter-item consistency (Cronbach's = .73).

### 2.3 Data Analysis

Correlation analysis was conducted into correlations between neuroticism, reappraisal, suppression and PSQI. Two moderation models were tested by regression analysis in SPSS Modprobe Macro (PROCESS), the detail interaction effects were tested by Johnson-Neyman technique [31]. According to Hayes and Matthes [31], Jonson-Neyman technique can cover the arbitrariness of the choice of values of the moderator of the pick-a-point approach. This technique can demarcate the points along the continuum of the moderator where the conditional

effect of independent variable on dependent variable transitions between statistically significant and not significant at the  $\alpha$  level of significance. Therefore, we can identify the “region of significance” of the effect of independent variable on dependent variable by using Jonson-Neyman technique. In regression analysis, neuroticism, reappraisal and suppression were all mean-centered. All analyses were run by program SPSS 21.0.

### 3. RESULT

#### 3.1 Characteristics of Participants

Total 142 participants’ data were analyzed, 52 were male (36.6%), and 90 were female (63.4%). The mean age of participants was 35.42 ( $\pm 9.69$ ) years. There were 110 (77.5%) participants were studying in college or graduate school, and 83 (58.5%) were single, 59 (41.4%) were in married. Forty three (30.3%) participants were Christians, 13 (9.2%) were Catholic, 7 (4.9%) were Buddhist and 79 (55.6%) were not having any religions. The mean PSQI score was 8.63 ( $SD=3.23$ ), which was over the sleep quality of clinical significance. There were 118(83.01%) participants having PSQI scores higher than 5, and 95 (66.90%) participants’ score of PSQI were over than 6. It indicates that about 67% participants were having moderate or severe poor sleep quality. The mean of daytime dysfunction was the highest ( $1.73\pm.67$ ), sleep duration was the second ( $1.53\pm.89$ ).

#### 3.2 Correlations of Variables

Results of correlation analysis with controlling age, sex, education level, marriage and religion were presented in table 1 below. Female participants were more neurotic ( $r = -.26, p < .01$ ), and male participants were having more poor sleep quality ( $r = -.19, p < .05$ ). Neuroticism had a significant correlation with PSQI ( $r = .31, p < .001$ ), and reappraisal ( $r = .28, p < .01$ ). Correlation between reappraisal and PSQI was also significant ( $r = -.53, p < .001$ ). Suppression didn’t have any significant correlations with other variables.

#### 3.3 The moderating effect of reappraisal on the relationship between neuroticism and sleep quality.

As showed in table 2, after controlling by age, sex, education level, marriage and religion, reappraisal was entered into regression equation, then the effect power of model 1 was 54% ( $p < .001$ ). After the product of neuroticism and reappraisal was entered into model 2, the effect power increased up to 61% ( $p < .001$ ), the change of  $R^2$  was significant ( $B = -.02, F(1,132) = 22.50, t = -4.74, p < .001$ ). It indicated that the moderating effect of reappraisal on the relationship between neuroticism on PSQI (sleep quality) was significant. For describing more details, Johnson-Neyman technical was used to test the interaction of neuroticism and reappraisal [31]. The results were presented in table 3. It was showed that the higher of reappraisal, the lower of the effect of neuroticism on PSQI. Moreover, when the value of reappraisal reached 36.38, the effect of neuroticism on PSQI became to be insignificant. Figure 1 provided a visualization of the interaction. It means that reappraisal did buffer the link between neuroticism and sleep quality.

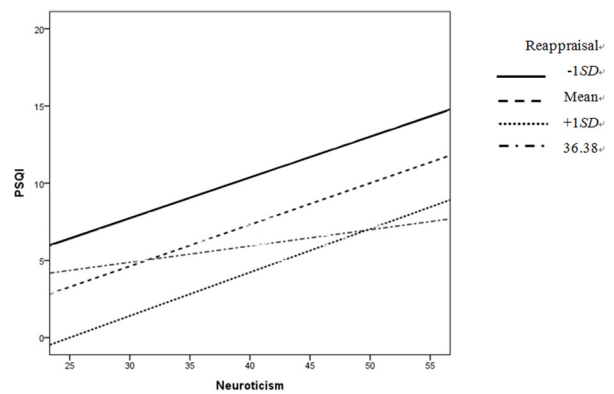


Fig. 1. Moderation effect of reappraisal on -1SD, Mean, +1SD and the value of 36.38.

Table 1. Correlations, means and standard deviations between variables

N=142	1	2	3	4
1. neuroticism	(43.85±5.90)	-	-	-
2. reappraisal	.28**	(29.17±6.03)	-	-
3. suppression	-.11	.09	(15.84±4.48)	-
4. PSQI (sleep quality)	.31***	-.53***	-.12	(8.63±3.23)
sex	-.26**	.00	-.17	-.19*
age	.07	.16	.15	-.00
education	.10	.02	-.02	-.12
marriage	.04	.08	.08	-.03
religion	-.01	.02	-.01	-.03

\*\* $p < .01$ , \*\*\* $p < .001$ ; ( ): (Mean±SD)

Table 2. Moderating effect of reappraisal on the relationship between neuroticism and PSQI (sleep quality)

	<i>B</i>	<i>SE</i>	<i>t</i>	$\Delta R^2$	<i>R</i> <sup>2</sup>	<i>F</i>	<i>df</i> <sub>1</sub>	<i>df</i> <sub>2</sub>
Model 1					.54	75.17***	2	139
constant	6.38	1.53	4.17***					
neuroticism	.28	.03	8.54***					
reappraisal	-.35	.03	-10.76***					
Model 2								
constant	10.14	1.58	6.41***					
neuroticism	.25	.03	7.72***					
reappraisal	-.38	.03	-12.01***					
Neuroticism × reappraisal	-.02	.00	-4.74***	.07	.61	67.92***	9	132
sex	-.34	.39	-.89					
age	.02	.02	.82					
education	-.13	.17	-.77					
marriage	-.12	.47	-.25					
religion	.02	.09	.20					

\*\**p* < .01, \*\*\**p* < .001

Table 3. Conditional effect of Neuroticism on PSQI at values of reappraisal

reappraisal	<i>B</i>	<i>se</i>	<i>t</i>	<i>LLCI</i> ( <i>B</i> )	<i>ULCI</i> ( <i>B</i> )
-1SD (23.14)	.38	.040	9.59***	.3025	.4597
Mean (29.17)	.25	.03	7.72***	.1872	.3162
+1SD (35.20)	.12	.05	2.71**	.0330	.2115
36.38	.10	.05	1.98	.0000	.1938

\*\**p* < .01, \*\*\**p* < .001; *LLCI*: the lower limit of *B* in 95% *CI*; *ULCI*: the Upper limit of *B* in 95% *CI*.

Table 4. Moderating effect of suppression on the relationship between neuroticism and PSQI (sleep quality)

	<i>B</i>	<i>SE</i>	<i>t</i>	$\Delta R^2$	<i>R</i> <sup>2</sup>	<i>F</i>	<i>df</i> <sub>1</sub>	<i>df</i> <sub>2</sub>
Model					.15	3.00**	8	133
constant	11.58	2.09	5.56***					
neuroticism	.17	.05	3.72***					
suppression	-.07	.06	-1.24					
Neuroticism × suppression	-.01	.01	-.86	.00	.15	2.26	1	133
sex	-1.08	.58	-1.88					
age	.01	.04	.19					
education	-.11	.24	-.44					
marriage	-.36	.68	-.53					
religion	-.12	.15	.85					

\*\**p* < .01, \*\*\**p* < .001

### 3.4 The moderating effect of suppression relationship between neuroticism and sleep quality

The same method was used to test the moderating effect of suppression on the relationship between neuroticism and sleep quality. After the product of neuroticism and suppression entered into the model, the effect power wasn't significant ( $B=-.01$ ,  $F(1,133)=2.26$ ,  $t=-.86$ ,  $p=.39$ ). Therefore, suppression didn't have a moderating effect on the relationship between neuroticism and sleep quality. Results were detailed in table 4.

## 4. DISCUSSION

As the necessary to put emphasis on sleep disorder suggested by DSM-5[32], poor sleep quality has become a more important issue than before. Present study tested the moderating effect of reappraisal and suppression on the relationship between neuroticism and sleep quality. We found a moderating effect of reappraisal on the relationship between neuroticism and poor sleep quality but not of suppression. Details were discussed as below.

In present sample, the mean PSQI score (8.63) was over the sleep quality of clinical significance, about 67% participants were having moderate or severe poor sleep quality. Although present sample was small, 77.5% of participants are in college or graduate school. Although it can't represent the whole Korean population, it did suggest that quite a bit of Korean might be suffering from sleep related problems, particularly to students in college and graduate. Moreover, daytime dysfunction and sleep duration might be the most popular area of poor sleep quality.

As suggested above, poor sleep quality was found to be related to neuroticism in present sample. It was consistent with most of previous researches [7], [8]. The more neurotic of people are, the more likely to sense more stress and negative emotions, which influence sleep quality in a negative way [33], [34]. Preview researches on circadian rhythms have found that neuroticism showed rhythms of activity and temperature with greatly different periods from other personalities [35], [36]. As the close correlation between circadian system and sleep, neuroticism might have an effect on sleep quality in a negative way. Eysenck and Eysenck [4] also argued that arousal level is higher in neuroticism than extraversion, which means individuals high in neuroticism are likely to get activation easily even without special stimulus. Therefore, individuals high in neuroticism may be more sensitive to daytime stressors or sleeping environment before or during sleeping time, which makes them more anxious, worried and tense, and as a result they can't have a good sleep.

Emotion regulation is a procedure to regulate positive or negative emotion of subject, it can be conscious or unconscious; adaptive or maladaptive [14]. Reappraisal, as an adaptive emotion regulation strategy, has been found that has a positive effect on emotion related problems such as mood disorder [24]. Moreover, suppression has been defined as a maladaptive emotion regulation strategy [37], which may contribute to anxiety and mood disorder [14]. Several preview researches have already showed that neuroticism was related to negative

psychological consequences but buffering from some strategies of emotion regulations [38]-[40].

In the moderation model of reappraisal, we found the interaction between neuroticism and reappraisal on sleep quality was significant. It indicated that even though high neuroticism predicts poor sleep quality, if reappraisal is used enough, the link could be fail. Reappraisal refers to thinking about a way that can decrease emotional intensity when facing an emotional stimulus or situation [37], has been found to involve in reducing subjective negative emotion, and relate to positive interpersonal function and well-being [24]. It makes sense that reappraisal as a cognitive change focusing on dealing with subject's negative emotions can play a buffering effect on negative emotions such as anxiety, worry or tension caused by neuroticism, and consequently protect subject's sleep quality from influences of those negative emotions.

However, suppression's moderating effect wasn't significant. In other words, the relationship between neuroticism and sleep quality wasn't affected by suppression, no matter high or low. Gross and Levenson [23] suggested that for negative emotions such as sadness, suppression does not provide relief from the subjective experience of that emotion, thus as a route to the alleviation of negative feelings, hiding one's emotions is unlikely to help one feel better. However, it does not mean that restraining emotional impulses (e.g., to yell or to hit) is never desirable. In fact, it's easy to imagine circumstances under which it is better for one's own (and others') psychological health and general well-being to reduce one's emotional expressive behavior. Besides, contrary to western countries, Korea is a typical representative of collectivistic culture, which based on Confucianism culture. Korean believes that expressing emotions is not a mature coping skill in communication. Suppression can help them in keeping good interpersonal relationship [41]. Suppression for Korean may be just a general learned coping technology to a degree. In addition, suppression related researches were almost based on Westerners. On this account, the role of suppression for Korean might be different from Westerners. Since the effect of suppression on sleep quality is unclear for Korean, it's necessary to find out in detail in future research.

Our findings can be summarized of that reappraisal had a buffering effect on the relationship between neuroticism and poor sleep quality however suppression did not have the moderating effect on that relationship. It inferred that reappraisal may be an important clinical therapeutic element for people with high neuroticism and having poor sleep quality. These findings supplied an important foundational data for understanding people with poor sleep quality, especially for neuroticism.

Several limitations and directions for future research were considered as below. First, present study as a cross-sectional study, can't clarify the cause and effect relations. Second, as previously discussed, 142 participants cannot be representative of all population. Therefore there is a generalization problem in this study. Third, it is a weakness for using self-report measure to assess emotion regulation and sleep quality. Future studies would benefit from utilizing alternative assessment methods to test the moderating effect of emotion regulations.

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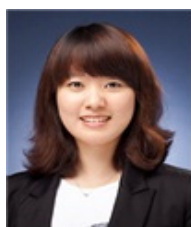
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