

Comparison of Psychophysiological State Effect by Korean National Police Agency's Psychological Competency Reinforcement Workshop. Analysis using the test results for 3 years

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Abstract: *Since a study showed that 19.9% of the scientific investigators are vulnerable to post-traumatic stress disorder due to frequent contact with shocking and hateful murders and decomposing corpses, the Korea National Police Agency has held the yearly workshops since 2018. As a result, the quantitative measurement of psychophysiological state (PPS) and workshop effect for scientific investigators was required, and 'MAUMLENZ' program, a psychophysiological test equipment, developed using Vibraimage technology, was used. From 2019 to 2021, 120 scientific investigators who participated in the workshop were tested for psychophysiological state before and after. Among the various PPS indicators of 'MAUMLENZ', the effects before and after workshop were compared using the indicators of 'Brain Fatigue' state and 'Comprehensive analysis classification'. 'Brain Fatigue' state can be a comprehensive indicator of the overall health status of the brain. The normal health group increased from 71.4% to 87.9%, improving by 16.5% points. In addition, the caution and risk groups decreased significantly from 28.4% to 12.1% (-16.3%). The average index of Brain Fatigue conditions before workshop was significantly improved from -0.728 to -0.108. In the 'comprehensive test classification', the normal health group increased from 60.5% to 69.3% (+8.8%). The rest group decreased from 22.9% to 18.6% (-4.3%), and the care group also decreased from 16.5% to 12.1% (-4.4%). Therefore, it was analyzed that the workshop to strengthen psychological competency has the effect of improving the emotional, psychological, and mental state of scientific investigators.*

Keywords: *Vibraimage, Psychophysiological state, MAUMLENZ, Brain Fatigue, Comprehensive analysis classification.*

Introduction

In recent years, the suicide rate of police officers has increased rapidly in 2021. Twenty (20) police officers made the extreme choices in 2019, 24 in 2020, and 21 in 2021. This can be said to be a fairly high level compared to the extreme choice ratio of other public officials in special jobs (KHN, 2020). According to media reports,

the suicide rate of police officers is 2.5 times higher than that of all civil servants. Analysts say that although various complex reasons such as health, economy, and job stress must have worked until individuals made extreme choices, the ‘organizational culture’ inside the police may have been a major factor. Police officials who have witnessed suicide by fellow police officers cannot be dismissed as a simple problem in that the chain reaction makes it more difficult to actively provide security services as they feel helpless (Kim, 2017; Han, Park, 2015).

According to the results of a study on the stress inducing factors of police officers (AD, 2012), it was found that the trigger was high in the order of personnel management, job characteristics, and physical environment factors. among the stress inducing factors. Personnel management and physical environmental factors can be improved by institutions or policies, but since job characteristic factors have low variability, research on the degree of stress by subdividing job characteristics is necessary. As a result, 19.9% of the high-risk groups of post-traumatic stress disorder (PTSD) were found in 2017 by the Gwangju Metropolitan Police Agency as a result of a study on post-traumatic stress disorder (Raichile, 2001).

In addition, psychophysiology test data are used as basic data for identifying soldiers’ mental health status and establishing plans for improving mental health, and cases of increasing synergy when professional psychological counselors consult soldiers have already been confirmed and verified in pilot operations for military soldiers.

Korean National Police Agency promoted a workshop to strengthen the psychological competency enhancement of scientific investigators, and used non-contact, invasive methods and human rights-friendly ‘MAUMLENZ’ equipment used in polygraph tests to understand the effects and psychophysiology of the scientific investigators. A live video was taken and tested using a ‘MAUMLENZ’ device developed using Vibrainage technology that measures psychophysiological state in a non-contact manner. The psychophysiological parameters provided by ‘MAUMLENZ’ program consist of comprehensive analysis classification (three group classifications and all 11 detailed categories), Brain Fatigue indicator, vitality and concentration, 10 psychophysiological state parameters, affective state and distribution, and energy metabolism and psychophysiological information (MINDEYE, 2018; 2019).

In this study, scientific investigators participating in the psychological competency reinforcement workshop conducted by Korean National Police Agency compared the effects before and after participating in the workshop and used them as data to evaluate the effectiveness of the program contents.

Materials and Methods

Research has been actively conducted that the brain is tired due to excessive activation of the Default Mode Network (DMN) (Raichile, 2001), which is activated when nothing is done without any special psychological, pathological, or physiological causes. Brain scientists believe that we feel tired not because we are tired, but because of ‘brain fatigue’. The real tired part is not the body, but the brain (Those who are tired even if they rest, Dr. Lee Si-Hyung) (MINDEYE, 2018; Lee, 2019).

The vestibular system that contributes to human balance and spatial orientation is a sensory organ that provides a sense of movement and equilibrium. It is known anatomically that the vertical head position is controlled by vestibular system through the head-neck. This vestibular system is connected to the sensory organs, nerve organs, and all parts of the human body.

Therefore, the three-dimensional trajectory of head movement is very complicated, and the vestibular system, such as sensory organs, usually respond to stimuli (Minkin, Nikolaenko, 2008; Minkin, Myasnikova, 2020; Barany, 1914), and gravity is consistently stimulated, so vertical head muscle movements are transmitted to physiological processes such as electrocardiogram, pulse, brain and skin reactions.

The human head moves slowly when it is calm and stable, and moves quickly and often when it is active and excited. This vestibular-emotional reflex (VER) is determined dependent on the spatial and transient kinetic energy distribution regulated by vestibular system according to human psychophysiological state (Minkin, Nikolaenko, 2008; Minkin, Myasnikova, 2020; Barany, 1914).

Vibraimage provides information corresponding to the information that can be obtained by using point-to-point biomedical methods, i.e., EEG, SGR, and ECG. The head micromovement analysis model and physics laws based on Vibraimage technology convert head movement behavior and physical energy from scientific figures to psychophysiological emotional states (Minkin, 2017).

Emotions and vestibular system operations are reported to be closely correlated (Joseph, 2009) and correlated with EEG, showing a 92.9% coincidence rate when diagnosing attention deficit hyperactivity disorder (ADHD) (Choi, Jung, 2018). As a result of correlating EEG and Vibraimage data when expressing emotions, variables measured in Vibraimage are closely correlated with brain function and emotion, such as extracting parameters with significant differences (MINDEYE, 2018; Minkin, Nikolaenko, 2007).

The brain fatigue state index was developed using parameters measured by Vibraimage technology, and the brain fatigue status index is divided into three stages: health (-2.0 or higher), caution ($-2.0 \sim -5.0$), and severity (less than -5.0), and caution and severity are strictly applied as criteria for detecting the abnormal state (MINDEYE, 2018).

Background of Contactless Psychophysiological State Testing

There are various methods of measuring psychophysiological state, such as psychology diagnosis test, psychophysiological test and evaluation and physiological test. Each test may have an advantage, but it takes about 2 hours on average and there is a limitation in that a recording device must be attached. The Vibraimage system is a method of analyzing the fine tremors of the face by taking a live video for one minute, and is efficient for examiners and examinees due to low restrictions on execution and evaluation.

The reliability of this measurement was based on the results of psychophysiological diagnosis of Russian nuclear workers using Vibraimage parameters and correlated with psychophysiological tests such as Minnesota Multiphasic Personality Inventory-2 (MMPI-2), cartel tests, raven tests, blood pressure changes, and psychophysiological

test like tension and hand-foot reactions and responses to moving objects. 98.8% accuracy was obtained (Bobrov et al., 2016).

Subject for Testing

The subjects who attended the psychological competency reinforcement workshop were measured for 1 minute each before and after workshop, and it took about five minutes on average, including explanation time per subject. The measurement was carried out by installing two 'MAUMLENZ' inspection equipment in a separate space in which the noise was relatively suppressed and a free atmosphere was created.

As a scientific investigator who participated in the Korean National Police Agency's psychological competency reinforcement workshop, a total of 120 scientific investigator were tested for 3 years, targeting 29 investigators in 2019, 31 investigators in 2020, and 60 investigators in 2021. The measurement was performed using Notebook PC (connected camera: Logitech 930C model) equipped with 'MAUMLENZ' program to measure and analyze psychophysiological conditions, and the measurement method was performed in which the subject sat comfortably for 1 to 2 minutes in front of the camera, with the eyes open and staring straight ahead.

Results

3-1. Effect Comparison of Brain Fatigue state between pre-workshop and post-workshop

In 'Brain Fatigue' state, a comprehensive indicator of overall brain health, the proportion of normal health groups improved by 16.5% from 71.4% before participation in the workshop to 87.9% after participation. The state group significantly decreased by -15.2% from 27.3% to 12.1% (Fig. 1).

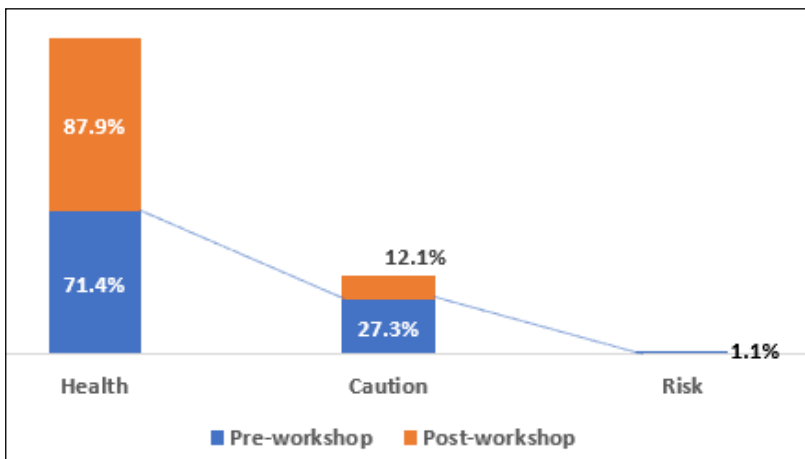


Fig. 1. Effect comparison of Brain Fatigue state for 3 year average between pre-workshop and post-workshop

As a result of verifying the change in brain fatigue state over 3 years compared before and after the subjects who participated in the psychological competency reinforcement workshop, the average of brain fatigue state showed a significant difference. It was -0.728 before the workshop, but later improved significantly to -0.102 (Table 1).

Table 1

Difference of Brain Fatigue state between before workshop and after workshop

Group	Subject	Mean	Standard Deviation	<i>t</i>	<i>p</i>
Before workshop	120	-0.728	0.742	0.212	0.001
After workshop	120	-0.102	0.42		

The change in brain fatigue conditions measured before and after the workshop conducted in 2020 was the biggest, and the index -1.55 before the workshop improved to -0.45 (Fig. 2).

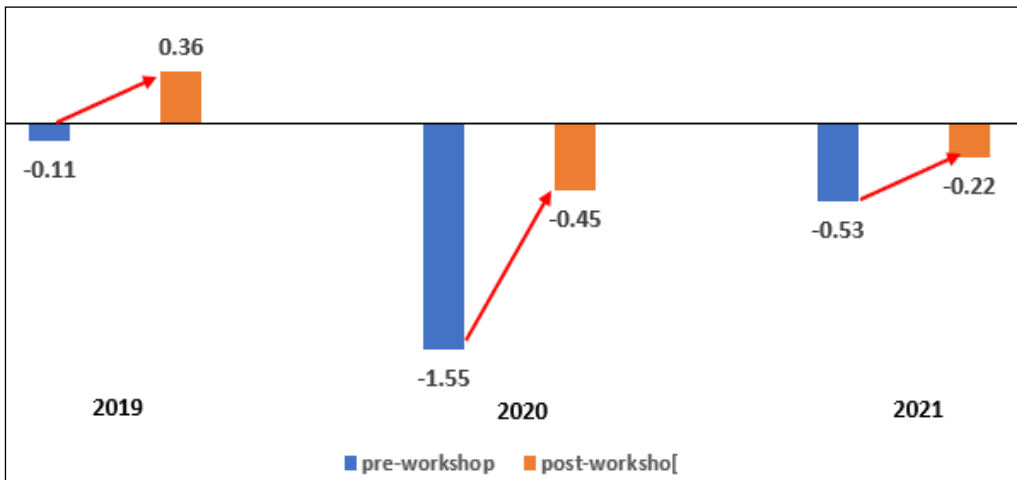


Fig. 2. Yearly comparison of Brain Fatigue state between pre-workshop and post-workshop

In particular, when comparing the average value of brain fatigue state by year, the average value of brain fatigue state in 2019 before COVID-19 infection was 0.13, but worsened to -1.0 in 2020, and improved to -0.37 in 2021, when COVID-19 infection was prolonged.

This seems to be due to the social and environmental impact of the psychological and mental state due to COVID-19 infectious disease (Fig. 3).

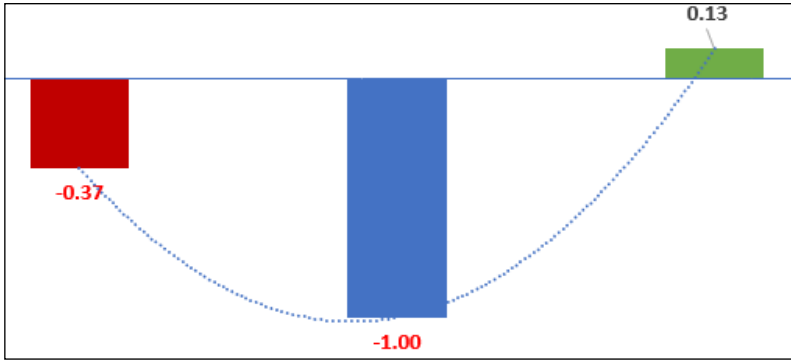


Fig. 3. Comparison of Brain Fatigue state for 3 year average

Comparison of the Comprehensive Analysis Classification Results

Comparing pre-workshop and post-workshop conditions into three groups (normal health, rest/healing, and care groups), the ratio of normal health group increased (+8.8%) from 60.5% to 69.3%, the ratio of rest/healing group decreased (-4.3%) from 22.9% to 18.6%, and the ratio of care group decreased (-4.4%) from 16.5% to 12.1% (Fig. 4).

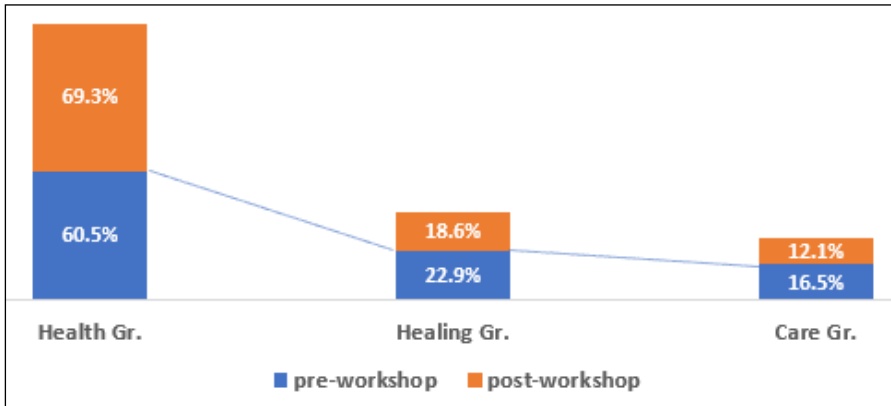


Fig. 4. Comparison of comprehensive analysis classification for 3-year average

Conclusion

The Brain Fatigue state of 120 scientific investigators who participated in the psychological competency reinforcement workshop for 3 years from 2019 year is a comprehensive indicator of overall brain health conditions, and the normal health group increased from 71.4% to 87.9%, improving by 16.5% points. The healing and care groups decreased significantly from 28.4% to 12.1%. The average index of brain fatigue

conditions pre-workshop was significantly improved from -0.728 to -0.108. In addition, comparing the annual changes in brain fatigue state, it was 0.13 in 2019, but worsened to -1.00 in 2020 when the COVID-19 pandemic spread, and slightly improved to -0.37 in 2021, when the COVID19 was prolonged, but it still did not reach the condition before COVID-19 infection.

In the comprehensive analysis classification, the normal health group increased (+8.8%) from 60.5% to 69.3%, the rest/healing group decreased (-4.3%) from 22.9% to 18.6%, and the care group also decreased (-4.4%) from 16.5% to 12.1%. Therefore, it was analyzed that the workshop to strengthen psychological competency has the effect of improving the emotional, psychological, and mental state of scientific investigators. In particular, the care healing group and subjects diagnosed with brain fatigue as caution and risk state need counseling on stress and difficulties in job or organizational culture and psychological counseling of a psychological approach.

Improving psychological and mental conditions in a short period of time, by workshops, is limited and difficult, so it is necessary to establish a system for continuous management and monitoring of mental health on a daily basis to provide services to investigators as well as police officials.

It can help to improve self-efficacy in mind, mental health, and work ethic by showing the quantitative indicators of psychophysiological state tested by 'MAUMLENZ' to easily recognize and empathize with one's unbalanced condition.

In addition, post-traumatic stress disorder (PTSD) for scientific investigators dispatched to traumatic events externally was recognized as an infringement of mental health and served as an opportunity for improvement. It sympathized with the difficulties of the field that could not be appealed by the nationwide scientific investigators, and then formed a work ethic that strengthened to support their colleagues. This is expected to spread to scientific investigators and lead to a sense of self-efficacy in scientific investigation work.

Scientific investigators can prevent and strengthen their status only when they know their psychophysiological state correctly by expanding the opportunity to check their current state.

The psychological shock of the scientific investigation who are continuously exposed to traumatic events should be properly cared and resolved. When the positive elements of the psychophysiology of scientific investigators are consciously and unconsciously expressed, the proactive and high-quality safety services can be provided to the public.

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