

Study on the Countermeasures of Military Organizations Through Analysis of the Impact of COVID-19 Pandemic on Psychophysiological State of Soldiers

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Abstract: This study is aimed at accurately analyzing the impact of COVID-19 pandemic on soldiers' psychological conditions and seeking ways to respond, considering the prolonged period of COVID-19 infectious diseases and the shorter and shorter time of the emergence of new viruses. This study was measured using 'MAUMLENZ' (Vibraimage System), a live video-based non-contact artificial intelligence smart device, to analyze the impact of COVID-19 on soldier psychology, and the subject of measurement was arbitrarily selected from soldiers. Based on the results of the measurements in 2019, before the outbreak of COVID-19, the test results in 2020 after COVID-19 outbreak showed a significant increase in soldiers' symptoms of 'Stress' and 'Lethargy/Depression' and 'Brain Fatigue' index was worsened significantly. In 2021, when the COVID-19 infectious disease was prolonged, the number of signs of Lethargy/Depression continued to increase, and the index of 'Brain Fatigue' improved slightly, but the negative emotional state deteriorated significantly.

Therefore, in order for the military to effectively respond to the prolonged COVID-19 infectious disease and the emergence of a new virus, it is necessary to establish a system to interview and consult with commanders in a timely manner, activate physical exercise at individual and small groups, and create video call conditions for soldiers to families and friends more frequently, and also can find out that more efforts were needed to stabilize the affective state of soldiers.

Based on the research results, if the corresponding countermeasures are systematically established in advance to respond effectively to the emergence of a new virus, it will stabilize a psychophysiological and mental conditions such as Stress relief and Lethargy/Depression, and prevent non-combat losses, and improve the reliability and confidence of the army.

Keywords: COVID-19 pandemic, MAUMLENZ, Brain Fatigue index, Military accident and suicide prevention, Affective state, vibraimage.

Introduction

Currently, the world is having more difficult times than ever in all fields, including society, economy, and culture, due to the COVID-19 infectious disease. COVID-19, a respiratory infection disease, was the first infectious disease in China in December 2019, and is a new virus that appeared after SARS in 2002, novel swine-origin influenza in 2009, and MERS in 2015.

The government classifies schools that live in groups when infectious diseases appear, call centers where many people work together in small spaces, and nursing facilities where elderly people with poor health live together as vulnerable groups and takes various measures such as quarantine. However, the military, where hundreds of people from all over the country gather and live in groups, is controlling and taking measures by the military itself in consideration of its specificity. The military is a group that is very vulnerable to infectious diseases due to group life, and if it does not actively respond to the emergence of new viruses such as COVID-19, it can cause many non-combat losses like the Spanish flu in World War I, and not only the military's morale but also the public's confidence.

Due to COVID-19, the military is controlling and limiting soldiers' vacations, going out, and staying out overnight at each stage of the situation, controlling family visits, and strongly implementing preventive measures such as social distancing within the unit. In addition, with the development of science and technology, mobile healthcare can be implemented using smart watches or smart bands information on the human body (Lee, 2017; Kim, 2017; Han, 2017).

Therefore, this study aims to stabilize the psychological state of soldiers, prevent non-combat losses, and improve the reliability of the military by accurately analyzing the impact of COVID-19 pandemic on soldiers' psychology, analyzing it with objective data (Minkin, Nikolaenko, 2008; Minkin, Myasnikova, 2020; Bobrov et al., 2016) and studying countermeasures.

Using 'MAUMLENZ' (Vibrainage system) (MINDEYE, 2019; Choi, 2018; Lee, 2019), which is an artificial intelligence smart device that can measure soldiers' Psycho-Physiological State (PPS) in a non-contact manner, data tested before COVID-19 (2019 May-September) and airborne units with the least change after COVID-19 outbreak (2020 April-October) were tested, in 2021 (March-August), when COVID-19 pandemic was prolonged, the results of expanding and testing the subjects were used to compare and analyze changes in psycho-physiological state of soldiers before and after the outbreak of COVID-19 and due to the prolonged COVID-19 pandemic.

Vibrainage technology used in the study is based on the principle that human instinctively engages in regular vibration movements to balance their heads three-dimensionally, which varies with PPS (Minkin, Nikolaenko, 2008; Minkin, 2020; Carmona, 2009). It is a non-contact device that captures micromovement of the head to analyze the correlation between information of live video image and brain waves and heart rate variability to extract algorithms and measure the subject's PPS with quantitative indicators Minkin, 2020; MINDEYE, 2019; Carmona, 2009).

Through this study, it was found that COVID-19 pandemic increased soldiers' symptoms of 'stress' and 'lethargy/depression' and worsened 'brain fatigue' (MINDEYE, 2019; Choi, 2018; Lee, 2019), and conducted surveys and interviews with soldiers to study and present countermeasures necessary for psychological stability. Based on this study, it is expected that if the system is established in advance, it will help our very vulnerable military to prevent non-combat losses and become a trusted army by the people in the event of infectious diseases such as new viruses.

Materials and Methods

2-1. Theoretical background

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 the vestibular system through the head-neck. This vestibular system are connected to the sensory organs, nerve organs, and all parts of the human body. Therefore, the three-dimensional trajectory of head movement is very complex, and usually the vestibular system responds to stimuli, such as sensory organs, and since gravity is giving constant stimuli, vertical head muscle movements are transmitted to physiological processes such as electrocardiogram, pulse, brain response, and skin response (Minkin, Nikolaenko, 2008; Minkin, 2020; Joseph, 2009). 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 the vestibular system according to human PPS (Minkin, Nikolaenko, 2008; Minkin, 2020; Lee, 2019).

Vibraimage provides 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, Nikolaenko, 2008; Minkin, 2020).

How to select subject to measure

The subjects of measurement included general soldiers, junior officers, and officers. Tests were conducted on 333 subjects in 2019, before the outbreak of COVID-19 pandemic, 230 subjects in 2020 and 1,425 subjects in 2021 after COVID-19 infection.

The measurement equipment, 'MAUMLENZ', was measured using Notebook PC installed with a customized application (MAUMLENZ) to measure PPS and Logitech 930C camera.

The testing method was measured for 1 minute after the subject sat comfortably in front of the camera and stabilized.

Measurement parameters

It was analyzed using various indicators provided by the 'MAUNLENZ' using Vibraimage technology to measure PPS (Minkin, 2020; MINDEYE, 2019; Choi, 2018). The main indicators provided by 'MAUMLENZ' equipment are brain fatigue, comprehensive diagnostic results (classified into normal/health, healing, care groups), affective state, 10 parameters (Aggression, Stress, Anxiety, Suspect, Balance, Charm, Energy, Self-regulation, Inhibition, Neuroticism), concentration, vitality, etc.

Results

Comparison of comprehensive PPS analysis results

As a result of comprehensively classifying psychophysiological conditions into three groups (normal/health, healing, and care groups), the normal/health group was 76.6% before COVID-19 pandemic happened in 2019, but decreased significantly to 39.1% dramatically after COVID-19 was occurred in 2020, and 41.7% in 2021. In particular, the proportion of care group increased significantly from 3.8% before the outbreak of COVID-19 to 20.9% (+17.1%) in 2020 and 27.9% (+24.1%) in 2021. It can be seen that the psychophysiological conditions of soldiers got seriously worse due to the prolonged COVID-19 (Fig. 1).

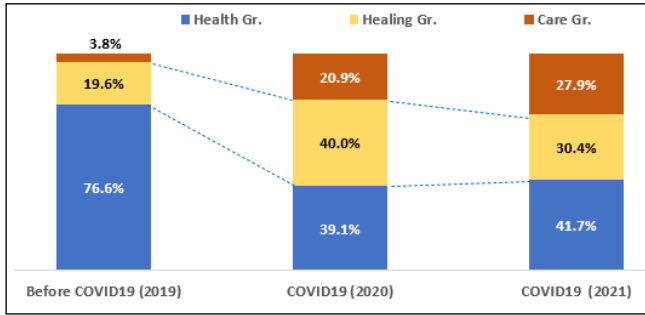


Fig. 1. Comparison of Comprehensive analysis result

Also, compared to the test results before the COVID-19 outbreak in 2019, in 2020, immediately after the outbreak of COVID-19, ‘Stress’ (+26.6%) and ‘Lethargy/Depression’ (+18.7%) increased significantly, and in 2021, ‘Pleasure-Displeasure’ (+17.9%) and ‘Lethargy/Depression’ (+7.8%) increased significantly. (Fig. 2).

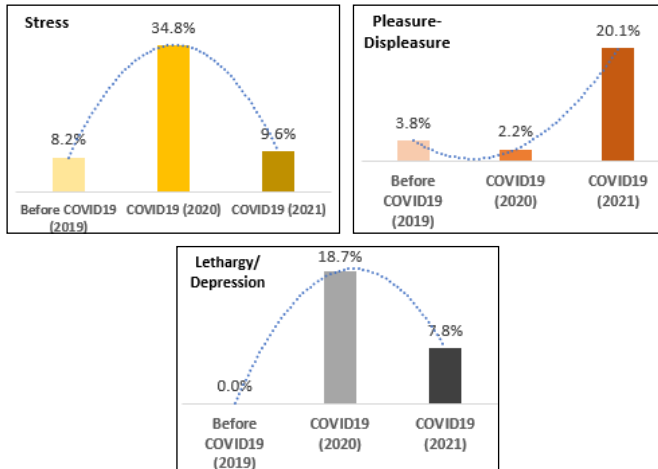


Fig. 2. Comparison of Stress, Pleasure-Displeasure, Lethargy/Depression

Comparison of Brain Fatigue state

Brain fatigue is a comprehensive indicator of the overall brain health of the subject, and the brain health of soldiers before COVID-19 was very healthy as 0.7 Brain Fatigue index. However, as COVID-19 banned and controlled the on-duty service activities for a considerable period of time, the PPS condition significantly was weakened, leading to decrease in Brain Fatigue index to -1.74 in 2020 and -1.00 in 2021 after COVID-19. When the brain is tired, work efficiency decreases, and the brain function may not work well and may be impaired, and at the end lead to increase the risk of safety accidents and suicide (Fig. 3, Table 1).

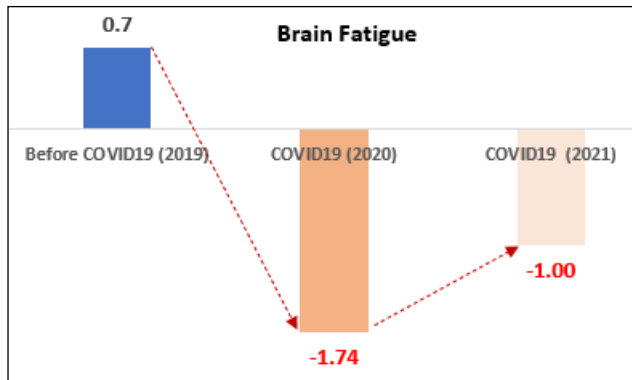


Fig. 3. Change and comparison of Brain Fatigue index for 3 year

Table 1

Differences of Brain Fatigue state by year of examination (2021~2020 year vs. 2019 year)

Year	Numbers	Mean	Standard Deviation	t	p
2020 ~ 2021 year (After COVID-19)	1,655	-1.37	1.43	1.86	0.01
2019 year (Before COVID-19)	333	0.7	1.312		

Comparison of significant PPS parameters

The positive emotions of PPS, ‘Balance’ and ‘Self-regulation’, and ‘Affective state’, decreased after the outbreak of COVID-19, and in particular, ‘Balance’ and ‘Affective state’ decreased significantly in 2021 as shown in Figures 4-1 and 4-2.

From these results, it can be seen that ‘Balance, Self-regulation, Aggression and Information of PPS’ of the mind deteriorated due to the prolonged COVID-19 (Fig. 4).

Balance was decreased from 69.9 to 58.7 (-11.2), Self-regulation was from 69.1 to 62.4 (-6.7), Aggression was from 38.3 to 41.4 (+3.1) and Information of PPS was from 44.8 to 39.2 (-5.6).

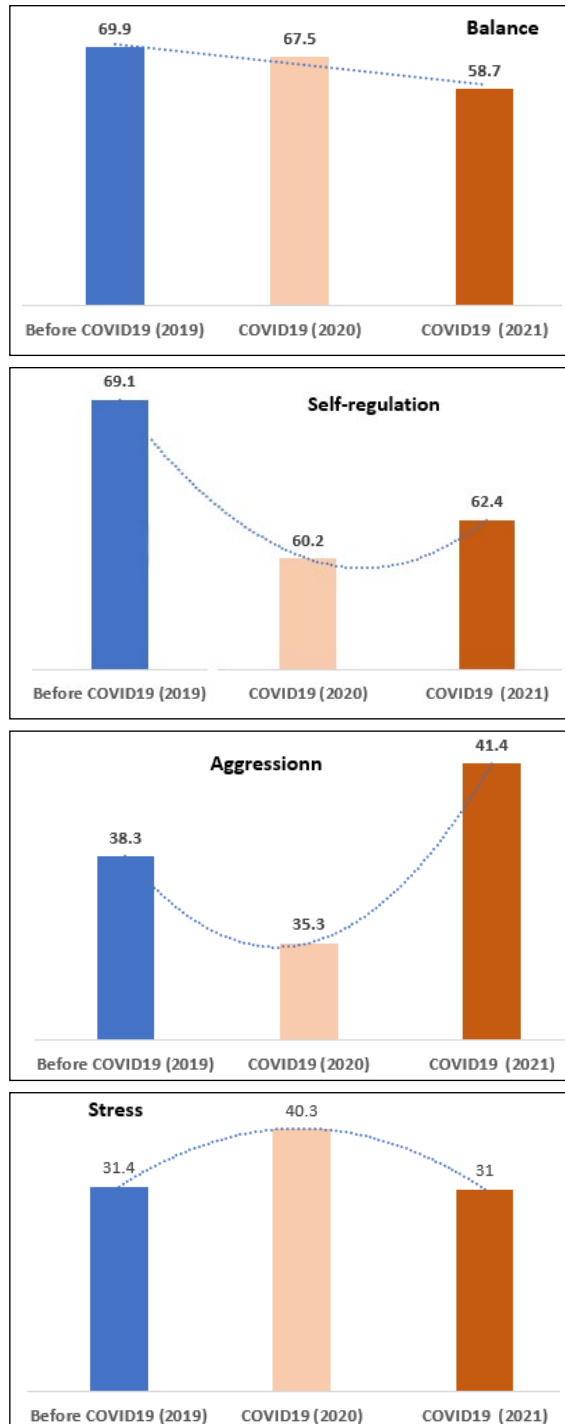


Fig. 4. Comparison of the significant parameters

Discussion and Conclusion

Before COVID-19, soldiers generally showed a positive and active state of PPS, but after COVID-19, their PPS state was unpleasant and less motivated, increased Stress, Lethargy and Depression, and Brain Fatigue got worse. As a result of conducting surveys and interviews with soldiers, the biggest reason for psychological anxiety is to be blocked from the outside due to restrictions on meetings and visits. Therefore, it is necessary to establish a system that regularly checks the psychophysiological state of soldiers using smart equipment and promotes psychological stability through interviews and counselling with commanders for soldiers with abnormal conditions.

In addition, we found out that it was important to prevent stress by taking measures to activate individual and small-scale physical exercise, and to create conditions for freely making video calls with family, lovers, and friends so that they could not feel disconnected from the outside.

Based on the results of this study, it is suggested that the smart measurement system and management system will be established in the future. Data such as executive interviews, counseling, new personality tests, relationship type test results, growth environment, and hospital treatment, which are currently being conducted by the unit for personal management of soldiers, are needed to accumulate.

1. The biological signal measuring equipment like 'MAUMLENZ' is needed to operate additionally and quantitatively data the results of periodic inspections.
2. Artificial Intelligence (AI) analyzes and monitors psychophysiological state (PPS) change of each soldier.
3. By notifying the commander and counselor of a mentally unstable soldier, based on the PPS testing results.

It is necessary to establish a "PPS analysis and management system using AI" that can be pre-emptively managed. For screened soldiers, the customized measures such as counseling with military life counselors, interviews/encouragement with commanders, medical treatment with military doctors, and vacations are required depending on individual PPS.

According to individual resilience, there is a significant difference in stress received in the same situation, but the research on soldiers' resilience is still insufficient. This study did not consider the impact of individual resilience, but compared and analyzed using data measured before and after COVID-19 pandemic.

Further research is needed on the effects of resilience and analysis of the fear about apologetic mind and reproach for the unit and comrades of COVID-19 confirmed patients in the future. In addition, based on the research results, the systematic response to the emergence of a new virus will stabilize the PPS of soldiers, such as relieving stress, and preventing non-combat losses to enhance the reliability and confidence in the military.

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