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ORIGINAL ARTICLE

Assessment of SIBALERA Neck Pillow With Autonomous Sensory Meridian Response (ASMR) to Attention Function Among Medical Students in Indonesia

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ABSTRACT

Introduction: The quality parameter of a country's education is closely related with learning achievement, where attention plays an important role. In support of learning achievement, individuals often enforce their study time till induce stress or physical fatigue over a long term. Neck pillow is often used as a media at rest for body's relaxation. The Autonomous Sensory Meridian Response (ASMR) can also provide relaxation and can trigger the release of dopamine hormone which functions as a neurotransmitter in the attention process. Based on these problems, we design a research on SIBALERA; a portable neck pillow with ASMR stimulation can improve attention function. **Methods:** This research used an experimental design of three parallel groups pre and post-test design. The participant (n=48) was randomly divided into three groups. The control group was not given any intervention (n=16), intervention group 1 was given regular neck pillow without ASMR stimulation (n=16), and intervention group 2 was given SIBALERA (n=16). ASMR stimulation was given by hearing twenty minutes before the participants went to sleep at night for two weeks.The attention function were measured used the Attention Network Test (ANT) the day before and after the intervention. **Results:** The result showed a significant difference scores of attention functions including alerting, orienting, and executive in the intervention group 2 ($p<0.001$) than the other two groups. **Conclusion:** In summary, SIBALERA with ASMR stimulation can effectively improve the attention function.

Keywords: ASMR, Attention function, Attention Network Test, Neck Pillow, SIBALERA

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INTRODUCTION

According to Le Pelley et al., attention is a condition when individuals focus on an object with a decrease in focus on the general circumstances around them (1). Attention is a condition that is the opposite of being confused, dazed, and careless. If there is a disruption with the attention function, the individual will easily experience stress, decreased cognitive function, and difficulty concentrating and learning new things. If this situation lasts for a long period, it can result in a decrease in productivity which can further increase unemployment. Meanwhile, increasing the attention function will result in a students with high competitiveness and increase in a company's profit (2-4).

On the other hand, Barrat EL and Davis NJ revealed a previously unknown sensory phenomenon that is now attracting a lot of public interest known as Autonomous Sensory Meridian Response (ASMR) (5,6). Generally, ASMR is achieved by auditory and visual stimuli which will induce someone to feel relaxed, preceded by a "tingling" sensation that spread across the skull and down through the back of the neck. Throughout its development, ASMR stimuli are mostly packaged in the form of podcasts and Youtube videos. There are various types of ASMR stimuli, such as whispering sounds, personal attention, and crisp sounds (ibid).

A previous research explains that Nucleus Accumbens (NAcc) in the brain will be activated when individuals are given ASMR stimulation (7). NAcc activation often involves dopamine as a neurotransmitter in attention function. Furthermore, whispering sound as the most effective ASMR stimulation technique is known to be able to initiate the release of oxytocin and dopamine hormones which play an important role in attention (7,8).

After knowing the relationship between ASMR and some parts of the brain, a research to prove the superiority of

ASMR on improving attention function is needed. This is also supported by the lack of research and information in the community about the benefits of ASMR. Based on this problem, we conduct a research and proudly present the effect of neck pillow with ASMR stimulation to improve attention function among medical students in Indonesia. This research present as a solution which can even become an inventory technology that will develop in the future and will create opportunities to assist technology in the medical field.

MATERIALS AND METHODS

Research Design and Study Variables

Three paralleled groups experimental design consisted of pre and post-test design is used in this research, which was conducted in January-June 2020. This research was carried out in the physiology laboratory of the Faculty of Medicine at Diponegoro University, an institution located in the city of Semarang, which was accredited by the Ministry of Education and Culture as an educational institution in Republic of Indonesia. The independent variable of this research is using regular neck pillow without ASMR stimulation and SIBALERA with ASMR stimulation. Meanwhile, the dependent variable of this research is attention function.

Participants

Participants were medical students who were registered as active students from Faculty of Medicine Diponegoro University, Semarang academic year 2018, aged 18-25 years old, either male or female, and willing to be a participant. Participants were selected by purposive sampling.

Participants that had a history of brain injury or head trauma, history of central nervous system infections, history of psychiatric disorders, musculoskeletal abnormalities of the hand that made it difficult to operate a laptop for ANT test were excluded. Participants from the control group and intervention group 1 were not allowed to listen to ASMR stimulation. Other than that, participants from the intervention group 2 that did not follow the procedure of using SIBALERA for two weeks were dropped out.

From the results of previous studies, it is known that the mean ANT score of the control group is 96.16 ± 1.23 (9). So, the sample size calculation to prove the hypothesis with an average difference between the two populations becomes:

$$n = 2\left[\frac{(Z\alpha + Z\beta)SB}{X_1 - X_2}\right]^2$$

$$n = 2\left[\frac{(1.96 + 0.842)1.23}{96.16 - 94.47}\right]^2$$

$$n = 8.317$$

$$n_t = \frac{n}{(1 - do)}$$

$$n_t = \frac{8.317}{(1 - 0.1)}$$

$$n_t = 9.241$$

Based on these calculations, it was found that the number of samples needed was 27 people with 9 people in each group. Therefore, because this research uses 48 people and 16 people in each group, this research fulfills the requirements to prove the hypothesis.

Tools and Materials

The tools we used in this research are regular neck pillow, SIBALERA, smartphones, and laptops. The materials used in this research are ASMR stimuli, *Attention Network Test* (ANT), participant questionnaire, and informed consent papers.

Procedure

Participants that had already been given an explanation about the research and had signed the informed consent paper were then randomly allocated into three groups. Control group was not given any intervention; Intervention group 1 was given regular neck pillow without ASMR stimulation; Intervention group 2 was given SIBALERA to listen ASMR stimulation for twenty minutes before going to sleep for two weeks.

Researchers measured attention to each subject using the Attention Network Test (ANT) program on the computer provided by researcher. In each group, pre-test before the two weeks intervention was carried out and post-test after the two weeks intervention. Jin Fan et al had developed Attention Network Test (ANT) software to measure three aspects of the attention function, namely alerting, orienting and executive (10). ANT had been widely used to measure attention because it was considered to had actual efficiency and was quite easy to do using computer system (3). The attention function was measured using the ANT which has four blocks; The first block for the trial stage and the other three blocks were the experimental blocks. In the trial block, the subject could find out whether he is responding correctly (correct), wrong (incorrect), or not responding (no response) so that subject could understand the test instructions properly. The subjects would be asked to press keyboard of PC as fast as possible according to arrows that appear on the laptop screen. The arrows that appear could be preceded by instructions on where the cursor and flankers appear. Arrows could appear from above or below the fixation point in the form of a positive sign (+), consisting of central arrow surrounded by flanking arrow that can point in the same (congruent) or the opposite (incongruent) direction. The result of the ANT calculation was in the form of milliseconds, where this calculation is done automatically by the ANT software (10).

The ASMR stimuli could be accessed by a link that was given by the researcher through online chats at 21.00 WIB. ASMR stimuli could be heard using smartphone connected to SIBALERA via bluetooth while still paying attention to the placement of mobile phones of at least 1.5 meters to prevent excessive radiation exposure from mobile phones (11). To avoid biased research, at 21:30 WIB the researcher followed up the participants via online chat to make sure they had watched the ASMR stimulus that had been given. The questions to follow up the participant are as follows:

a. Have you used SIBALERA?
b. What sound did you hear from the ASMR stimulus?

The researcher then measured the attention function from each group using the ANT the day after the intervention ended at the same time as the pre-test.

Ethics Approval

Ethical clearance was obtained from the Health Research Ethics Commission (HREC) Faculty of Medicine at Diponegoro University with No. 52/EC/KEPK/FK-UNDIP/IV/2020.

Data Analysis

The data are analyzed with the Shapiro-Wilk normality test. The hypothesis about differences in attention functions both alerting, orienting, and executive scores before and after intervention was tested using the Paired Sample T-test on each group because the data was normally distributed.

Furthermore, the hypothesis about differences of pretest, posttest, and the differences from the attention function score both alerting, orienting, and executive score between the control group, intervention group 1, and intervention group 2 was tested using ONE-Way ANOVA test because the data are normally distributed, except the difference score of the executive function that is tested using the Kruskal Wallis test. Comparison of sleep quality and attention function scores both alerting, orienting, and executive between the control group, intervention group 1, and intervention group 2 using the Post Hoc Bonferroni test.

RESULTS

Characteristic of the Participant

Table I showed that the total participant (n=48) was divided equally in each group; control group (n=16); intervention group 1 (n=16) and intervention group 2 (n= 16). Each group has the same sex ratio between male (n=8) and female (n=8). The mean age in the intervention group 2 was younger than the control group and intervention group 1, but the differences were not significant (p=0.570; Kruskal Wallis test).

In this research, none of the participants dropped out. All participants, both in the control group, intervention group 1 and intervention group 2 have never had a history of brain injury or head trauma, history of central nervous system infections, history of psychiatric disorders, and also never had a musculoskeletal abnormalities of the hand that made it difficult to operate a laptop for ANT test.

Table I: Characteristic of the participants (n=48)

Variables	Group			p
	Control (n=16)	Intervention 1 (n=16)	Intervention 2 (n=16)	
Age (years old)$	19.70±0.675; 20 (19-21)	19.50±0.527; 19.50 (19-21)	19.40±0.516; 19 (19-20)	0.570**
Sex; n (%)				1.000*
- Male (n=24)	8 (50%)	8 (50%)	8 (50%)	
- Female (n=24)	8 (50%)	8 (50%)	8 (50%)	
History of brain injury or head trauma				
- Yes	0 (0%)	0 (0%)	0 (0%)	
- No	16 (100%)	16 (100%)	16 (100%)	
History of central nervous system infections				
- Yes	0 (0%)	0 (0%)	0 (0%)	
- No	16 (100%)	16 (100%)	16 (100%)	
History of psychiatric disorder				
- Yes	0 (0%)	0 (0%)	0 (0%)	
- No	16 (100%)	16 (100%)	16 (100%)	
Having musculoskeletal abnormalities of the hand that made it difficult to operate a laptop				
- Yes	0 (0%)	0 (0%)	0 (0%)	
- No	16 (100%)	16 (100%)	16 (100%)	

$The table shows Mean±Standard Deviation; Median (Min-Max)
*Chi-Square Test
**Kruskal Wallis Test

ANT Score Measurement Result

Alerting Score Measurement Result

The table II showed that the results of the ANT pretest score in the control group (40.40±8.086) was lower than intervention group 1 (41.10±9.267) and intervention group 2 (47.90±7.490). However, the differences were not significant (p=0.102; One-Way ANOVA). The results of the ANT post-test score of the intervention group 2 (21.20±7.955) was lower than the intervention group 1 (36.70 ± 16.418) and the control group (41.60±7.947). Based on tests using One-Way ANOVA, significant

Table II: ANT score of the alerting in the control, intervention group 1 and 2

Measurement Time	Group			$p^{§}$
	Control (n=16)	Intervention 1 (n=16)	Intervention 2 (n=16)	
Pretest	40.40±8.09; 40.00 (24-52)	41.10±9.27; 40.00 (27-57)	47.90±7.49; 50.50 (30-55)	0.102§
Post-test	41.60±7.95; 43.00 (31-54)	36.70±16.42; 39.50 (18-74)	21.20±7.96; 23.00 (11-36)	0.001§*
$p^{¶}$	0.719¶	0.254¶	<0.001¶*	
Differences of *Pretest* and *Post-test*	-1.20±10.21; 1.00 (-19-12)	4.40±11.42; 5.00 (-17-19)	26.70±11.10; 29.00 (7-40)	<0.001§*

The table shows Mean±Standard Deviation; Median (Min-Max)
* Significant (p < 0.05); ¶ paired-samples T-test; § One-Way ANOVA

differences in post-test scores were obtained (p<0.001).

Based on table II, there was a reduction of ANT scores in intervention group 1 and intervention group 2. The reduction of ANT scores in intervention group 1 (p=0.254; Paired samples T-test) was not significant, whereas intervention group 2 had a significant reduction in ANT score (p<0.001; Paired Samples T-test). On the other hand, the control group experienced an insignificant increase in ANT scores (p=0.719; Paired samples T-test).

Figure 1 showed an insignificant ANT pretest and post-test scores between control group and intervention group 1 (p=0.78). Meanwhile, there was a significant difference in pretest and posttest results between intervention group 1 and intervention group 2 (p<0.001), similarly between intervention group 2 and the control group (p<0.001).

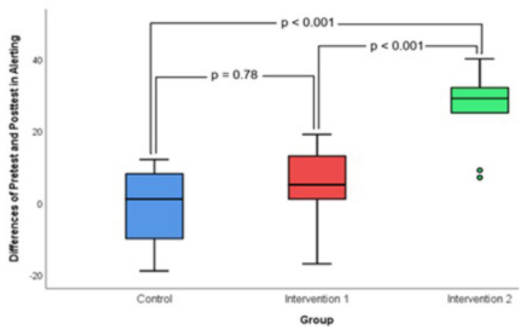

Figure 1: Difference between ANT Alerting scores at pretest and post-test in the control, intervention group 1 and intervention group 2. Significant value is p<0.05

Orienting Score Measurement Result

Table III showed that the ANT pretest score in the intervention group 2 (46.60±8.113) was higher than the intervention group 1 (38.80±7.177) and the control group (38.20±13.815). Based on the One-Way ANOVA test, it showed that this difference was not significant (p=0.137). Furthermore, the post-test score of intervention group 2 (21.70±6,360) was lower than intervention group 1 (35.40±11,955) and the control group (39.70±13,350). However, the differences were significant (p=0.003; One-Way ANOVA test).

Based on the table III, there was a reduction of ANT score in the intervention group 2 that was significant (p<0.001; paired-samples T-test). There was also a reduction of the ANT score which was using the paired-samples T-test in the intervention group 1, but it was not significant (p=0.280). Meanwhile, there was an escalation of the ANT score in the control group that was not significant (p=0.666).

Figure 2 showed a significant result of differences in the pretest and posttest scores between intervention

Table III: ANT score of the orienting in the control, intervention group 1 and 2

Measurement Time	Group: Control (n=16)	Intervention 1 (n=16)	Intervention 2 (n=16)	p$
Pretest	38.20±13.82; 36.50 (21-58)	38.80±7.18; 39.50 (29-48)	46.60±8.11; 48.00 (35-58)	0.137$
Post-test	39.70±13.35; 37.00 (21-62)	35.40±11.96; 33.50 (21-57)	21.70±6.36; 22.00 (13-32)	0.003$*
p¶	0.666¶	0.280¶	<0.001¶*	
Differences of *Pretest* and *Post-test*	-1.50±10.63; -1.50 (-18-15)	3.40±9.35; 4.50 (-11-16)	24.90±10.35; 23.00 (8-40)	<0.001$*

The table shows Mean±Standard Deviation; Median (Min-Max)
* Significant (p < 0.05); ¶ paired-samples T-test; $ One-Way ANOVA

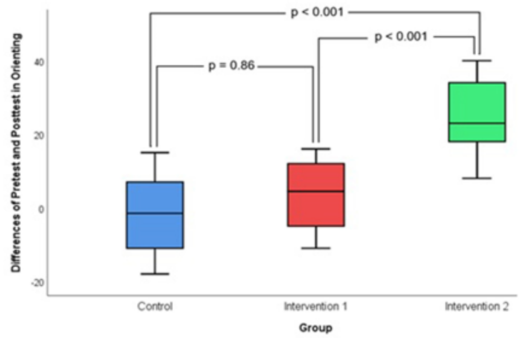

Figure 2: Difference between ANT Orienting scores at pretest and post-test in the control, intervention group 1 and intervention group 2. Significant value is p<0.05.

group 2 and intervention group 1 (p<0.001), similarly between the intervention group 2 and the control group (p<0.001). Whereas in the intervention group 1 with the control group there were differences in the pretest and posttest scores of ANT which were not significant (p=0.86).

Executive Score Measurement Result

Table IV showed that the pretest score in intervention group 2 (107.60±9.501) was higher than intervention group 1 (100.00±12.266) and the control group (97.40±14.073). However, the difference was not significant (p=0.166; One-Way ANOVA). ANT post-test scores in intervention group 2 (66.00±7.674) was lower than intervention group 1 (97.80±10.963) and the control group (101.40±9.823). One-Way ANOVA test showed that the difference in post-test scores was significant (p<0.001).

Based on table IV, there was a significant reduction of ANT score in the intervention group 2 (p<0.001; Paired samples T-test). In the intervention group 1, there was also a reduction of ANT score even though it was not significant (p=0.491; Paired samples T-test). On the other hand, there was an escalation of ANT score in the control group but it was not significant (p=0.177; Paired

Table IV: ANT score of the executive in the control, intervention group 1 and 2

Measurement Time	Group			$p^{§}$
	Control (n=16)	**Intervention 1 (n=16)**	**Intervention 2 (n=16)**	
Pretest	97.40±14.07; 91.00 (77-118)	100.00±12.27; 99.00 (78-119)	107.60±9.50; 108.00 (96-124)	0.166[§]
Post-test	101.40±9.82; 98.50 (89-121)	97.80±10.96; 98.50 (78-114)	66.00±7.67; 66.00 (54-77)	<0.001[§*]
$p^{¶}$	0.177[¶]	0.491[¶]	<0.001[¶*]	
Differences of *Pretest* and *Post-test*	-4.00±8.641; -7.50 (-12-12)	2.20±9.69; 8.00 (-14-11)	41.60±6.64; 42.50 (31-50)	<0.001[¥*]

The table shows Mean±Standard Deviation; Median (Min-Max)
* Significant (p < 0.05); ¶ paired-samples T-test; § One-Way ANOVA ¥ Kruskal Wallis

samples T-test).

There was a significant result on the difference of pretest and post-test ANT score between intervention group 2 and control group ($p<0.001$), as well as between intervention group 2 and intervention group 1 ($p<0.001$), which can be seen in Figure 3. However, the difference in pretest and posttest scores of ANT was not significant between the control group and intervention group 1 ($p=0.30$).

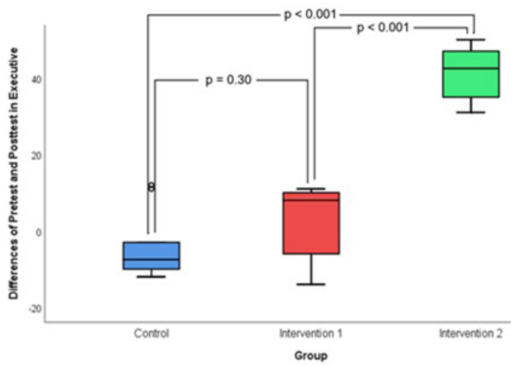

Figure 3: Difference between ANT Executive scores at pretest and post-test in the control, intervention group 1 and intervention group 2. Significant value is $p<0.05$.

DISCUSSION

This research showed a significant difference scores of attention functions including alerting, orienting, and executive in the intervention group 2 which was given SIBALERA with ASMR stimulation for two weeks with a duration of twenty minutes before going to sleep at night, compared to intervention group 1 which was only given a regular neck pillow and the control group that was not given any intervention. In addition, there was no significant difference between the intervention group 1 and the control group. It was proven by the significant reductions from the pretest to post-test ANT score in the intervention group 2. Similarly, there was a reduction from the pretest to post-test ANT score in the intervention group 1, but it was not significant. Conversely, there was an escalation in pre-test to post-test ANT scores in the control group and it was not significant. The results of this research are consistent with the hypothesis which stated that the use of SIBALERA can significantly improve attention function, compared to the usage of regular neck pillows and the control group.

The participants were using SIBALERA with various ASMR stimulation techniques every day for two weeks. However, in this research, the most stimulation techniques used in the ASMR stimulation were whispers. According to a research conducted by Barrat in 2015, whispering was a stimulus with the highest percentage of success in achieving ASMR with 75% success rate from 475 participants (5). Whispering is a technique of speaking by maintaining the vocal cords position, in order to prevent it from vibrating which will produce turbulence when the individual exhales breath that can be felt by the other person. This whispering technique can stimulate the brain which can initiate the release of dopamine and oxytocin hormone (8). The dopamine hormone (DA) is a neurotransmitter that plays an important role in executive functions, as one of the functions of attention (7). This has led to an increase in executive function which is very significant in individuals who use SIBALERA.

The executive function is a conflict resolution process that arises when the attention process is taking place (12,13). The executive function is closely related to dopamine. The dopamine hormone is a monoamine neurotransmitter, which is derived from amino acids. The parts of the brain with the highest concentration of dopamine are the substansia nigra and the Ventral Tegmental Area (VTA) in the midbrain (14). The hypothalamus and olfactory bulb are also parts of the brain with high dopamine concentrations, but not as high as in the substansia nigra and VTA. Dopamine has several pathways namely nigrostriatal, mesocorticolimbic, and tuberoinfundibular pathway. However, only the mesocorticolimbic pathway plays a role in the attention function (12).

The mesocorticolimbic pathway is responsible for the distribution of dopamine in the VTA to the prefrontal cortex which will be distributed to the Nucleus Accumbens (NAcc) and other areas of the limbic system (14). The high concentration of dopamine in the prefrontal cortex which plays a role in executive function is also one of the causes of increased attention function, especially executives in individuals who use SIBALERA.

A previous research conducted by Lochte BC et al. Stated that based on *functional Magnetic Resonance Imaging* (fMRI) examinations, there was an increase in NAcc, dorsal Anterior Cingulatus Cortex (Dacc) and Inferior

Frontal Gyrus (IFG) activation in individuals who were receiving ASMR stimulation (15). NAcc is one part of the brain with high dopamine concentrations, in addition to the Substance of the Nigra and VTA (7). Therefore, an increase in NAcc activation accompanied by high dopamine concentrations in NAcc will lead to a better executive function in individuals who are listening to ASMR stimulus.

Orienting or often referred to as visual attention is a process of directing attention to the source of stimulation that aims to strengthen the excitement, while other stimuli that are considered insignificant will be ignored (16). The part of the brain that plays a role in the orienting function is Superior Colliculus (SC) which will project visual signals to VTA, triggering the release of dopamine hormone (3).

The SC also plays an important role in the alerting function. SC has direct projections to Substantia Nigra pars Compacta (SNc) and VTA (3). The SC-DA line is a more suitable path for delivering alerting signals than a reward and aversion signals, because SC has less response to reward delivery and aversive response. The sequence of events suggested is SC neurons will detect a stimulus and select it as possibly important to trigger an orienting reaction which furthermore will inspect the stimulus and trigger a DA alerting response that will cause a burst of DA in downstream structures (3,17).

Furthermore, the dopamine hormone will be transmitted to prefrontal cortex in the frontal lobe (17). The frontal lobe is the part of the brain that is responsible for alerting functions which help us to be aware of important events that might occur, and efforts to remember the various consequences that will occur for the choices to be chosen (17). On the other hand, the dopamine hormone is associated with receiving signals related to motivation, aversive, and alerting and then transmits them to different parts of the brain. This dopamine hormone will play a role in rewarding behavior towards an event, avoiding being involved in a conflict or hostility with other individuals, and ensuring that the alerting function can run as it should (17,18,19). Furthermore, the role of dopamine in the alerting and orienting functions is one of the supporters of the results of this research which states that there is a significant increase in individuals given SIBALERA with ASMR stimulation.

This research also found that the group which was given a regular neck pillow with twenty minutes duration for two weeks had an increasing attention functions both alerting, orienting, and executive. Even though it was not significant, it could be happening because it takes longer to improve attention function in the group that use regular neck pillows. It also emphasizes that SIBALERA which is using ASMR stimulation is more effective and efficient in improving attention function in a shorter time, which only takes two weeks.

The limitation of this research is the inability to control all activities of the participants, such as the different daily activities of the participants and their nutritional consumption. Researchers also could not control the motivation, interests, mood, and sleep hygiene of the participants during the pre-test and post-test.

The compromised samples and the analytes affected should be stated in the laboratory report to alert the staff to be more cautious during blood sampling. Lastly, customer feedback meetings can also be conducted to discuss the appropriate strategy that can be implemented for the improvement of the blood collection activity as well as the patients' care.

Nevertheless, this study has some limitations due to its small sample size. In this study, we are unable to detect other uncommon rejection criteria such as icteric or lipaemic samples. Hence, a big sample population or interventional study is recommended to reduce the bias. Considering that this is a retrospective study of LIS data, we are unable to investigate the clinical consequences of sample rejection in oncology patients. As the information is clinically important especially to the treating clinicians, a prospective study is recommended to evaluate the clinical consequences of sample rejection in oncology patients.

CONCLUSION

Based on this research, the usage of SIBALERA: portable neck pillow with ASMR stimulation with a duration of twenty minutes for two weeks at night before going to sleep has been proven to be an effective and efficient in improving the attention functions especially towards alerting, orienting and executive function. On the other hand, the usage of a regular neck pillow with the same period slightly improves an attention function with insignificant differences. This research is also expected to be applied to a wider population because the minimum sample size was fulfilled and follow-up procedures were carried out to reduce the bias of the research. Further comparison research between the effects of SIBALERA utilizing ASMR stimulation with other independent variables, such as mood, depression, individual with ADHD and neck pain symptoms is needed to prove other benefits of SIBALERA. Therefore, this will further prove the efficiency of SIBALERA as a solution in supporting technology in the healthcare sector.

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