IJHSR
ijhighschoolresearch.org
REVIEW ARTICLE

ASMR and Its Effect on Adolescence

Mai Izaki

Shanghai American School Puxi Campus, Minhang Huacaozhen No. 258, Jinfeng Road, Shanghai, 201100, China; maimai.izaki.x3@gmail.com

ABSTRACT: Autonomous Sensory Meridian Response (ASMR) is an emerging internet phenomenon characterized by tingling sensations and relaxation in response to specific auditory or audiovisual stimuli. While adolescents widely use ASMR for relaxation, sleep, and stress reduction, most research has focused on adults, leaving a gap in understanding its impact on developing brains. This review synthesizes current findings on ASMR's effects on adolescent mental health, sleep, and anxiety, highlights the neurobiological mechanisms involved, and discusses limitations in existing studies. The paper advocates for more empirical research to clarify ASMR's potential as a non-pharmacological intervention for adolescent insomnia, anxiety, and depression.

KEYWORDS: Behavioral and Social Sciences, Neuroscience, ASMR, Adolescents, Mental Health.

Introduction

Despite its increasing popularity, Autonomous Sensory Meridian Response (ASMR) remains understudied, mainly hindering our understanding of its potential as a valuable tool for promoting mental health and well-being. A search conducted on January 29th, 2025, yielded only 472 published articles involving ASMR-related research. While ASMR is currently trending and widely discussed in popular culture, the common experience of ASMR, such as the pleasure experienced by sounds such as rain tapping on the window or the satisfying sound of typing, has always been present. Autonomous Sensory Meridian Response (ASMR) combines positive feelings, relaxation, and a distinct tingling sensation on the skin, typically triggered by auditory or audiovisual stimuli such as tapping, whispering, or role-playing.[1,2] The term came to view after an internet trend in 2010, after being coined by YouTube's Jennifer Allen.[3] Since its popularization in 2010, ASMR has become especially prevalent among younger audiences, with platforms like YouTube and Spotify serving as primary access points. Specifically, Spotify is popular with younger generations, with 62% of monthly users between the ages of 18 and 34. The largest age group is between 18-24, making up 31.5% of users.[4] YouTubers specializing in ASMR have gained millions of subscribers(for example, Joyceful Tingles), a testament to how popular this phenomenon has become. Along with its rise in popularity, recent research on ASMR suggests that it may be a novel tool to improve mental health, especially among the youth who are most likely to be exposed to ASMR and interact with it as it becomes increasingly popular on the internet. Despite its popularity, research on ASMR's effects in adolescents remains limited, with most studies focusing on adults. Adolescents, whose brains are still developing—particularly the prefrontal cortex—may be more sensitive to ASMR's effects, making it crucial to investigate its potential benefits and applications for this age group.

Goals of this Review Paper:

The number of studies related to ASMR continues to rise, yet little is known about the relative impact of ASMR on adolescents. Deepening our understanding of the effects of ASMR on adolescents will allow for a clearer understanding of its effects on adolescents during development. Given the evidence of differences in youth's key sensory, emotional, and cognitive processes compared to adults, adolescents can be predicted to have a higher sensitivity to ASMR. The heightened reactivity of their sensory systems, as well as their development of the prefrontal cortex, potentially makes adolescents more sensitive to ASMR's stimulative effects. With its calming auditory and audiovisual stimuli, ASMR is an effective intervention to promote relaxation and enhance sleep quality, especially benefiting the youth. The possibility of using ASMR as a sleep aid for adolescents and using ASMR relaxation as an intervention for anxiety disorders has already been explored.[5,6] However, this research is still in its early stages.

This paper aims to advocate the essential need for more empirical research to determine the extent to which ASMR could be used to understand ways in which this phenomenon could be used as a temporary cure for insomnia, anxiety, and depression among adolescents. To do this, this paper will start by discussing how ASMR affects explicit areas of the brain and then discuss its effect on adolescents as a sleep aid that could combat insomnia and relaxation, which could combat anxiety.

Status of Adolescent Mental Health:

Adolescent mental health is a growing concern, with the World Health Organization reporting that 14% of teenagers experience mental health problems.[7]

Rates of anxiety and depression have increased significantly in recent decades, and insomnia affects nearly a quarter of adolescents. Compared to 1990, the number of individuals with anxiety disorders increased by 18.42% by 2019.[8] Although not globally, a study conducted on 167,783 adolescents aged 12-17 in the United States of America had increased rates of depres-

DOI: 10.36838/IJHSR85.11

sion, with 8.1% in 2009 compared to 15.8% in 2019.[9] Studies have shown that the number of adolescents with insomnia is as high 23.8% in some countries.[10]

ASMR's Correlation with Mental Health:

With ASMR's relaxation effects, how it could be used as a guide for some mental illnesses has sparked debate. A study conducted by Barratt and Davis in 2015 explores the extent to which ASMR can ease the symptoms of depression and chronic pain. This study gathered 475 participants, who were given a questionnaire to fill out and asked questions related to ASMR. When the participants were asked the reason why they engaged with ASMR, 70% agreed that it was "to deal with stress." 69% of the participants who scored moderate to severe on the BDI (Beck Depression Index) measuring the participants' mood (minimal: 0-13, mild: 14-19, moderate: 20-28, and severe: 29-63), with their reported scores improving with a mean of 38.75, in comparison to the participants who scored minimal or mild with an average improvement of 21.33, when listening to ASMR showing that ASMR eased their symptoms of depression.

Many efforts are effective when dealing with mental health, specifically, mental health medications. However, these methods are not always the preferred choice for everyone, as there are side effects to medication.[11] This includes as having drowsiness, restlessness, muscle spasms, tremor, dry mouth or blurring of vision for antipsychotics to treat psychosis or schizophrenia, constipation, blurred vision, weight gain for atypical antipsychotics also used to treat psychosis or schizophrenia, as well as impaired coordination, memory impairment, and drowsiness for benzodiazepines used to treat anxiety disorders, panic attacks, and phobias.[12] Traditional treatments, such as medication, often have undesirable side effects, highlighting the need for alternative interventions.

The Adolescent Mind:

Adolescence is a critical period of brain development marked by major changes in sensory processing and emotional regulation. It is often considered "a time of hypersensitivity to both appetitive and aversive emotional experiences."[13] During adolescence, the prefrontal cortex is still in development. This brain region controls our ability to regulate cognitive and emotional responses. In addition, other research has found differences in visual information processing in the striate and extrastriate cortices of youth compared to adults.[14] In a study that aimed to learn if adolescents would respond to high-stress or low-stress risk-taking, it was found that adolescent male decision-making under stress can lead to different behaviors compared to adults, which could be interpreted as them being more sensitive.[15]

One of the most important areas of development during this time is the prefrontal cortex (PFC), and within that is the medial prefrontal cortex (mPFC), which plays a crucial role in higher-order cognitive functions, including decision-making and emotional regulation. This brain region continues to mature well into the early 20s, meaning adolescents face difficulty in controlling their emotions and responses to sensory stimuli compared to adults. This is due to the mPFC being more sensitive as it needs to absorb a larger amounts of information. Adolescence is also where there is increased sensitivity to emotional stimuli, often driven by heightened amygdala activity, which can lead to a more intense response to external triggers, including auditory and visual stimuli.[17]

Results and Discussion

Section 1: Neurobiological Effects of ASMR:

As discussed before, ASMR (Autonomous Sensory Meridian Response) is a physiological phenomenon that is described as a "combination of positive feelings, relaxation, and a distinct, static-like tingling sensation on the skin."[2] The feeling of relaxation and pleasant tingling result from an ASMR intervention. Another study conducted in 2018 by Bryson C. Lochte does a comprehensive job of identifying what these pleasant tingling sensations and relaxation are and how they're created. The study had a simple design of 10 participants being put in an fMRI machine with 3 buttons each for a baseline, relaxing, or tingling sensation while watching 5 7-minute clips of ASMR they felt was the most stimulating for them. The study found that the feeling of "tingles" typically lasted about 5.9% of the whole ASMR experience and that they are the activation of the NAcc (nucleus accumbens), the mPFC(medial prefrontal cortex), and the insula.

ASMR triggers activation in brain regions associated with reward and relaxation, including the nucleus accumbens (NAcc), medial prefrontal cortex (mPFC), and insula.18 During this experiment, the right and left Nacc showed significantly more positive action when participants felt tingle sensations than baseline or relaxing sensations. When participants experienced relaxing moments, activation appeared in the mPFC. Relaxation was found to be the most prevalent sensation during this study, showing that tingling sensations during ASMR are linked to increased activity in these areas, with relaxation being the most reported effect.[18]

Activation in the mPFC was small but significant during the relaxing moments compared to baseline moments. Relaxation occurs as oxytocin binds to receptors in the mPFC, meaning that with the activation of the mPFC during ASMR, there is a greater potential contribution of oxytocin to produce the relaxing sensation during ASMR.[18] In this study, the mPFC was mentioned several times; however, the ages of the participants are not specified, so we cannot know how the results would differ if it were conducted on different age cohorts individually. The mPFC, which continues to develop into early adulthood, is particularly relevant for adolescents, who may experience heightened sensitivity to ASMR due to ongoing brain maturation.[16]

Section 2: ASMR as a Sleep Aid:

Lack of sleep has become all too common among teenagers, and ASMR, as a tool, has great potential as a possible solution to this problem. Sleep deprivation is common among adolescents, often due to academic pressures and lifestyle factors.[5] Sleep deprivation can impact their cognitive functions, emo-

tional regulation, and overall well-being.[19] A large percentage of 23.8% of adolescents suffer from insomnia.[10]

ASMR has been shown to improve sleep quality, with studies indicating that regular ASMR sessions before bed can reduce sleep onset latency and increase effective sleep duration.[20] Many apps have been developed based on ASMR to improve sleep quality. These apps, such as Sleeepmaker Rain1 and Sleepa, simulate sounds like rain against the window or wind to relax the user.[21] This is just one example of how ASMR has been used to improve sleep quality. ASMR has been proven to be a sleeping aid and even a temporary solution for sleeping problems such as insomnia.[5]

Much research has been conducted to show that ASMR can facilitate relaxation in adults.[22] Many teens use ASMR to relax before going to bed, smoothing the transition from wakefulness to sleep. The triggers, such as gentle whispering, tapping, or nature sounds, can create the feeling of "tingles," which is a pleasant shivering feeling traveling down the spine.[23] Furthermore, as ASMR is a tool that can be controlled, adolescents can select when they would like to listen to ASMR, making it a voluntary activity and enhancing its effectiveness as a sleep aid. This personalization may make ASMR more appealing than traditional sleep aids,[1] as it allows users to curate their experience according to their preferences, ensuring that these adolescents feel safe, as they would have the power to control the duration, as well as the triggers of ASMR they are experiencing.

For example, a study involving high school students in China found that 20-minute ASMR interventions significantly improved sleep quality, suggesting that ASMR could serve as a non-pharmacological aid for adolescent insomnia. This was a 5-day study conducted by Z. Wu, thoroughly investigating the effect ASMR has on sleep quality. In this study, 60 participants, with an even number of female and male participants aged 15-19, were put into four groups, each experiencing a different duration of ASMR intervention sessions before sleep. Group A was the control group, Group B had an ASMR intervention session for 10 minutes, Group C for 20 minutes, and Group D for 30 minutes. In this study, after each group watched non-dramaturgic ASMR for the allocated time of each group, the participants slept. The participants' sleep quality was measured using the Pittsburgh Sleep Quality Index and a mobile phone app to gather data on sleep patterns; objective sleep duration, effective sleep time, and overall sleep quality.

The results indicated that the number of days of ASMR interventions influenced the timing of objective sleep onset; sleep onset is the time it takes to go to sleep, meaning that the longer the participants experienced the ASMR intervention, the earlier the sleep onset. However, it did not significantly impact the duration of sleep. The duration of ASMR intervention significantly impacted effective sleep duration, with Groups A and C resulting in significant increases in effective sleep duration compared to Group B, suggesting that 20 minutes of ASMR is beneficial to increase effective sleep duration. Although not confirmed in *post hoc* analysis, ANOVA analysis suggested that the duration of ASMR intervention influenced subjective sleep quality. These results show that there was a "significant association between ASMR and improved sleep quality among high school students." ASMR is a proven tool that could help adolescents sleep. Given the prevalence of insomnia in adolescents, this study gives hope that ASMR is a tool that should be considered to be used as a potential solution, as an alternate way to a pharmacological way of treating insomnia.

Section 3: ASMR for Relaxation and Anxiety Reduction:

ASMR's potential as a relaxation tool extends to anxiety reduction.[6] ASMR is suggested to be a relaxational tool that could be used as a potential mood lifter for depression.[2] Studies have demonstrated that ASMR can lower anxiety levels in teenagers, as measured by standardized scales such as the Hamilton Anxiety Rating Scale (HARS).[6] Synesthesia is the production of a sense impression relating to one sense or part of the body by stimulation of another sense or part of the body.[24] Similar to other phenomena, such as synesthesia that can be experienced through auditory stimuli, the tingling sensation felt is similar to the relaxation experienced when listening to music, for example, classical music.[1,2,22] The difference between ASMR and this other sensory phenomenon is that while synesthesia can't be controlled, ASMR can be turned off by pausing the audio/video. The ability to personalize ASMR experiences and control exposure may enhance its appeal and effectiveness compared to traditional relaxation techniques.

ASMR allows listeners to escape for a brief moment because of its ability to engage individuals. One can focus on what is happening around them, and they can use their senses at the same time. In the previous Lochte study, significant brain activation in the mPFC was observed during ASMR.

This region of the brain is responsible for self-awareness, social cognition, and social behaviors, including grooming, and when the chemical oxytocin binds to receptors in the mPFC, it mediates relaxation responses. The activation of the mPFC during ASMR suggests that more oxytocin is released, resulting in relaxing sensations.

As mentioned before, the PFC does not develop in humans until early adulthood, meaning adolescents are more sensitive to reward than adults.[16] Adding to the statistics mentioned before, it is wise to consider the possible use of ASMR as a tool of relaxation and at least a temporary solution to anxiety in adolescents. This idea of ASMR is further reinforced in a study conducted by A. Firmansya, which explores the effect of ASMR on anxiety in teenagers, showing how anxiety is not only used for relaxation but also as a remedy for mental health issues. This study explores this idea by collecting 17 adolescents (6 male, 11 female) participants from the city of Palembang, Indonesia, and testing anxiety levels before and after ASMR intervention, measuring their anxiety level based on HARS (The Hamilton Anxiety Rating Scale). Their results show that ASMR can allow teenagers who feel anxious to become calmer and more relaxed, reducing their anxiety levels.

DOI: 10.36838/IJHSR85.11

Section 4: Limitations:

Although the studies discussed above help in highlighting and shedding light on this understudied area of research within ASMR, both papers have faults that should not be overlooked when referencing these papers.

The study by Wu *et al*. (2024) faces several limitations on the generalizability of the results. Due to the participants being from only 6 of the same schools in China, the results may differ if the participants in this study were from around the world, meaning that the study's results should not be applied globally. Furthermore, as the participants' sample size is only 60, the results have the possibility to significantly differ if the study were conducted on a larger scale, especially since the 60 people were broken into four groups, meaning there were only 15 people in each group.

To confirm the study's results and its generalizability, a recreation of this study on a larger scale with a larger diversity would be beneficial. However, this study also faces challenges with its ability to be recreated, as it misses some key information in its methods. First of all, although the study mentions that they used the Pittsburgh Sleep Quality Index to measure the participants' sleep quality, it does not mention the app they used to collect further data on sleep patterns, objective sleep duration, and effective sleep time. If this study were recreated, the same app would be used to get similar results, but this problem does not allow that. Furthermore, the study does not mention the participants' surroundings during the experiment. This study does not mention whether it was conducted within a lab or in the home of the participants. It doesn't mention the potential factors that could influence the time it takes for the participants to sleep, such as the participants' stress levels, the room temperature, or what specific time this experiment was conducted. We might get different results if the study were to be conducted in a more controlled environment of this study and yield more accurate results as to what would happen when interacting with ASMR before sleep.

The study done by Firmansyah *et al*. (2023) also has many limitations that affect its credibility. The first limitation of the study is its limited sample size, with only 17 participants. 6 of which are males, meaning there are about twice as many females in this study as males. The ratio is not very balanced, although it is important to mention that this fault is recognized in the discussion. A second issue is that this study does not have a diverse cast of participants, as all participants are from Palembang, Indonesia. Due to cultural differences, the stress of adolescents from Indonesia would differ from the stress of those who live in other parts of the world. These results cannot be applied to the global population and are only an analysis of what ASMR can do for the adolescents of Palembang, Indonesia, alone.

A recreation of this study with a larger sample size, wider diversity, and a more balanced ratio of females to males would further allow us to see the effect of ASMR on anxiety in all adolescents. The study's major limitation is its inability to be recreated as a study. It fails to mention the longevity of these ASMR interventions, failing to mention any controls or individual factors. This study only describes the individual factor as an intervention and fails to mention the conditions of the participants, the participants' surroundings, and how long these participants were exposed to ASMR. We do not know how many times this study was repeated for the duration of the whole experiment. Even with these faults, this study helps as a guide and introduction to show the potential of ASMR in helping adolescents relax and even overcome anxiety. More studies should be conducted to truly understand the beneficial aspects of ASMR being used as a relaxational tool for teenagers.

Section 5: Future Directions:

ASMR has the potential to become a solution to a few mental health problems. Even though the benefits of ASMR are becoming more widely recognized, there is still a research gap that focuses exclusively on how it affects teenagers. Knowing how ASMR affects this group's emotional and cognitive health is essential because they are especially susceptible to mental health problems, as seen in the statistics. Future research should examine how ASMR affects adolescents' anxiety, sleep patterns, and general mental health over the long run.

The studies that this paper has reviewed provide beneficial insight into how adolescents could use ASMR to deal with some mental health issues. Despite this, the limitations of these studies leave much to be desired. In both studies, the sample is too small and is not diverse enough; there is a need for a large-scale study of the effect of ASMR on adolescents to see if the application of the results of the previous studies is only local or global.

Existing studies on ASMR and adolescents are limited by small, geographically homogenous samples and a lack of methodological detail, which restricts generalizability. Many studies do not account for individual differences such as personality traits, cultural background, or exposure to relaxation techniques, all of which may influence ASMR responsiveness. Larger, more diverse studies are needed to confirm current findings and explore the long-term effects of ASMR on adolescent mental health. Trait-based variables can influence the "need for cognition(NCS)" and "need to evaluate(NES)." The hypothesis is that one's NCS and NES may change how receptive an individual is to ASMR. The lower one's need to evaluate or need for cognition, the more likely they may be to not downregulate their physiological response to ASMR. Recognizing these factors would be a huge step in guiding the advancements in understanding ASMR.

Potential Future Research:

Future research should investigate the impact of ASMR on adolescents with different personality traits, such as introversion and extroversion, and explore the role of parasocial relationships with ASMR content creators. Adolescence is a critical period for brain development, particularly the prefrontal cortex, and social relationships significantly influence this development. Introverted adolescents, who typically have fewer friendships, may be more inclined to form parasocial relationships with ASMRtists (content creators specializing in ASMR) than their extroverted counterparts, who often main-

tain a larger social circle. This study could provide valuable insights into how personality influences the perception and experience of ASMR in young people.

Another possibility to consider with this study is that extroverts who have few friends would be more inclined to form parasocial relations with ASMRtists instead of introverts, who may feel less need to feel these parasocial connections. Introverts tend to feel more energized when doing activities by themselves or in a smaller group, while extroverts feel energized when engaging with a large number of people. Introverts are more likely to be able to relax in a solitary environment, while extroverts are more likely to relax surrounded by many people. ASMR is an activity to relax. Extroverts with fewer friends, who may not meet their desire to socialize, may be more sensitive to building parasocial relationships with ASMRtists, and introverts with few friends who might not feel the desire to socialize may be less sensitive to building parasocial relationships with ASMRtists.

This study not only provides valuable insight into how ASMR can influence young people, but it also provides valuable insight into how parasocial relationships are built with one-sided intentions.

Potential Future Mental Health Applications:

Although ASMR is already a tool that can be accessed easily, these easily accessible ASMRs are not designed to treat mental health issues within adolescents specifically. There is also potential for developing ASMR-based interventions, such as personalized apps or school-based relaxation programs, to support adolescent mental health and well-being.

A way in which ASMR could be utilized is with an app that is designed to track sleep and health, whilst using ASMR to calm the user. Repetitive use of ASMR before bed has already been proven to be a factor that influences sleep onset; an app that allows the user to customize and personalize their own ASMR playlist to play before sleep onset would allow ASMR to be used as a sleep aid by adolescents, who struggle with sleep. Keeping track of sleep would allow them to see how their sleep quality improves as they use ASMR before bed. An app that acts as an intelligent assistant that schedules and customizes a time dedicated to relaxation would allow for better sleep and, therefore, better mental health.

Another way ASMR can be integrated into adolescents' daily lives is through the educational institution they attend. Educational institutions should consider implementing a 10-minute break during school hours to play ASMR to refresh and reduce cognitive workload, which can be measured with heart rate variability. High heart rate variability lowers mortality rates, while low heart rate variability increases mortality rates. An initiation to increase heart rate variability would positively influence adolescents and their health.

Conclusion

ASMR is a new topic in that it fosters a way for adolescents to deal with their mental health problems, making it an important area of research to study. ASMR is a promising tool for promoting relaxation, improving sleep, and reducing adolescent anxiety. While preliminary studies suggest beneficial effects, more rigorous, large-scale research is needed to establish its efficacy and inform practical applications. ASMR's accessibility and low risk profile make it an attractive option for adolescents seeking alternatives to traditional mental health interventions. These studies give hope for the future of ASMR and its benefits, highlighting the need for further study of its potential positive impacts on the mental health of adolescents.

Acknowledgments

The author thanks Dr. Kimberly Clark for mentorship and guidance throughout the preparation of this review.

References

1. Cash, D. K.; Heisick, L. L.; Papesh, M. H. Expectancy Effects in the Autonomous Sensory Meridian Response. *PeerJ* 2018, *6*, e5229. https://doi.org/10.7717/peerj.5229.
2. Barratt, E. L.; Davis, N. J. Autonomous Sensory Meridian Response (ASMR): A Flow-like Mental State. *PeerJ* 2015, *3*, e851. https://doi.org/10.7717/peerj.851.
3. Marcin, A. *Sounds that Feel Good: A Guide to the Autonomous Sensory Meridian Response (ASMR)*. Healthline. https://www.healthline.com/health/autonomous-sensory-meridian-response.
4. Gardner, T. *Spotify Statistics 2024: What's the Future of the Media Streaming App By Numbers*. VLink. https://vlinkinfo.com/blog/spotify-statistics/.
5. Wu, Z.; He, C.; Zhao, K. The Effects of Autonomous Sensory Meridian Response (ASMR) on Sleep Quality Improvement in Adolescents. *medRxiv (Cold Spring Harbor Laboratory)* 2024. https://doi.org/10.1101/2024.09.14.24312582.
6. Firmansyah, A.; Limasta, I. W.; & Tusyakdiah, H. The effect of autonomous Sensory Meridian response (ASMR) relaxation on anxiety in teenagers. *Journal of Psychology Today* 2023, 1(2), e107 https://digamed.net/index.php/psychologytoday/article/view/171
7. WHO. *Mental health of adolescents*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health.
8. Liu, X.; Yang, F.; Huang, N.; Zhang, S.; Guo, J. Thirty-Year Trends of Anxiety Disorders among Adolescents Based on the 2019 Global Burden of Disease Study. *General psychiatry* 2024, *37* (2), e101288–e101288. https://doi.org/10.1136/gpsych-2023-101288.
9. Wilson, S.; Dumornay, N. M. Rising Rates of Adolescent Depression in the United States: Challenges and Opportunities in the 2020s. *Journal of Adolescent Health* 2022, *70* (3), 354–355. https://doi.org/10.1016/j.jadohealth.2021.12.003.
10. Hysing, M.; Pallesen, S.; Stormark, K. M.; Lundervold, A. J.; Sivertsen, B. Sleep patterns and insomnia among adolescents: a population-based study. *Journal of Sleep Research* 2013, *22* (5), 549–556. https://doi.org/10.1111/jsr.12055.
11. Neuro Wellness Spa. *The Pros and Cons of Mental Health Medications: Psychiatry in Los Angeles*. Neuro Wellness Spa. https://neurowellnessspa.com/pros-and-cons-of-mental-health-medications/.
12. Demitri, M. *Common Side Effects of Psychiatric Medications.* Psych Central. https://psychcentral.com/lib/common-side-effects-of-psychiatric-medications#2.
13. Guyer, A. E.; Silk, J. S.; Nelson, E. E. The Neurobiology of the Emotional Adolescent: From the Inside Out. *Neuroscience & Biobehavioral Reviews* 2016, *70* (70), 74–85. https://doi.org/10.1016/j.neubiorev.2016.07.037.

DOI: 10.36838/IJHSR85.11

14. Siu, C.; Murphy, K. The Development of Human Visual Cortex and Clinical Implications. *Eye and Brain* 2018, *Volume 10*, 25–36. https://doi.org/10.2147/eb.s130893.
15. Uy, J.; Galván, A. Acute Stress Increases Risky Decisions and Dampens Prefrontal Activation among Adolescent Boys. *NeuroImage* 2017, *146*, 679–689. https://doi.org/10.1016/j.neuroimage.2016.08.067.
16. Walker, D. M.; Bell, M. R.; Flores, C.; Gulley, J. M.; Willing, J.; Paul, M. J. Adolescence and Reward: Making Sense of Neural and Behavioral Changes amid the Chaos. *The Journal of Neuroscience* 2017, *37* (45), 10855–10866. https://doi.org/10.1523/jneurosci.1834-17.2017.
17. Tottenham, N.; Galván, A. Stress and the Adolescent Brain: Amygdala-Prefrontal Cortex Circuitry and Ventral Striatum as Developmental Targets. *Neuroscience & Biobehavioral Reviews* 2016, *70* (1), 217–227. https://doi.org/10.1016/j.neubiorev.2016.07.030.
18. Lochte, B. C.; Guillory, S. A.; Richard, C. A. H.; Kelley, W. M. An FMRI Investigation of the Neural Correlates Underlying the Autonomous Sensory Meridian Response (ASMR). *BioImpacts* 2018, *8* (4), 295–304. https://doi.org/10.15171/bi.2018.32.
19. Rosenberg, C. *10 Effects of Long-Term Sleep Deprivation - Sleep Health Solutions*. Sleep Health Solutions. https://www.sleephealthsolutionsohio.com/blog/10-effects-of-long-term-sleep-deprivation/.
20. Hardian Hardian; Febriani, S. S.; Tanjung Ayu Sumekar; Muflihatul Muniroh; Endang Ambarwati. Improvement of Sleep Quality by Autonomous Sensory Meridian Response (ASMR) Stimulation among Medical Students. *Malaysian Journal of Medicine and Health Sciences* 2020, *16* (SUPP 14), 81–85.
21. Yoon, H.; Baek, H. J. External Auditory Stimulation as a Non-Pharmacological Sleep Aid. *Sensors* 2022, *22* (3), 1264. https://doi.org/10.3390/s22031264.
22. Sakurai, N.; Ohno, K.; Kasai, S.; Nagasaka, K.; Onishi, H.; Kodama, N. Induction of Relaxation by Autonomous Sensory Meridian Response. *Frontiers in Behavioral Neuroscience* 2021, *15*. https://doi.org/10.3389/fnbeh.2021.761621.
23. Mahady, A.; Takac, M.; De Foe, A. What Is Autonomous Sensory Meridian Response (ASMR)? A Narrative Review and Comparative Analysis of Related Phenomena. *Consciousness and Cognition* 2023, *109*, 103477. https://doi.org/10.1016/j.concog.2023.103477.
24. Synaesthesia | Synesthesia, N. *Oxford University Press eBooks* 2023. https://doi.org/10.1093/oed/1111844541.

Author

Mai Izaki is an aspiring scientist and student at Shanghai American School. She is interested in how external stimuli affect human behavior and feelings, which has led her to the field of neuroscience.