Reducing stress by relieving muscle tension in adolescents

By Keily Calderon

Contents

Abstract

Introduction: In recent years younger individuals are seen to develop more physical problems, such as bad posture, physical conditions, and headaches. These issues then lead into psychological problems, one of these leading problems is stress. Lots of prior research on older individuals have been done to see how to improve stress by relieving muscle tension but none on adolescents, especially upperclassmen high school students. So, this study aims to see how relieving muscle tension in students can impact the students' stress levels. **Methods:** The study focuses on the connection between muscle tension and stress, in order to see the correlation we compared yoga and a peanut massage roller (PMR) to see which had the most significant impact in the participants. Since there is no control group this research was quasi-experimental; it was conducted in the spam of 3 weeks, on 9, 11th and 12th graders from a Northern Virginia high school. The participants were put into one of the 3 groups. Group A focused on only yoga, B did only the peanut massage rollers, and C was a combination of both. They also did a perceived stress scale survey before and after each exercise to measure their stress levels. **Results:** At the end of the 3 weeks, we found that the pre-SD/mean and the post-SD/mean support the claim that relieving muscle tension can reduce cortisol levels in adolescents too. Specifically, group B had the best outcome because the mean wasn't too high or too low and the SD was the highest, which meant they had the most variation throughout the 3 weeks. **Conclusion:** Overall, we saw that reducing muscle tension does in fact help reduce stress levels in adolescents and using a peanut massage roller is the most effective way to achieve that.

Introduction

Everyone has experienced tension in their muscles at least once in their life. Usually when someone thinks of stiff muscles, they think of older individuals. However, muscle tension can happen to anyone. Muscle tension is a buildup of tension in the body's muscles; it usually happens in the "neck, the cervical area, the trapezius muscle, [and] the lower back" (Kennedy, 2015). The cause of muscle tension "may be due to stress, which can manifest physically. However, muscle stiffness can also be caused by physical activity, poor posture, whiplash, a lack of specific vitamins, dehydration, and poor blood circulation" (Kennedy, 2015). The trapezius area is where most of these physical factors end up harming. The trapezius is a "large, triangular, paired muscle located on the posterior aspect of the neck and thorax" (Sendić, 2023). Additionally, it "originates from the occipital bone at the base of the skull, the ligamentum nuchae, and the spinous processes of the 7th cervical and all the thoracic vertebrae" (Lanman, 2024). The "7th cervical" mentioned is also known as the cervical spine which helps support the head, neck, and connects to the spine, serving as a point of origin for the trapezius. Also, when the body muscles, such as the trapezius, are under stress it can transfer into mental health problems, like anxiety and depression. Muscle tension and stress act like a cycle, when someone gets stressed or is in a stressful environment; they get muscle tension and vice versa.

Literature Review

Physical factors that occur due to muscle tension

The main physical factor that causes muscle tension and causes stress is a condition known as 'tech neck'. Tech neck syndrome is a condition that occurs when someone looks down

for a prolonged period of time. According to the National Library of Medicine, they say that the one factor that has been affecting the increase of tech neck in recent years is “the use of personal computers and especially cell phones” (David et al, 2021). As technology improves and becomes more relevant, adolescents use phones, computers, and other devices, which leads to teens having a higher percentage of tech neck compared to other generations. David mentions a cross-sectional questionnaire from Thailand, a group of researchers in the department of pediatrics from the university of Chieti, did a study with 2750 adolescent participants. These researchers found “Thai school-age adolescents reported a high prevalence of neck and shoulder pain, as well as European adolescents (from 15% to 28%) and Chinese teen-agers (41.1%)” (David et al, 2021). These numbers illustrate the high percentages of pain in the neck, shoulders, and trapezius area that increase the probability of developing tech neck syndrome. Furthermore, this muscle tension caused by tech neck can cause other symptoms to develop.

One of these symptoms from muscle pain that was said by the researchers from the university of Chieti was “headaches, [which is] the most common musculoskeletal pain symptom [which was seen to be] the highest prevalence in Thai school-age adolescents” (Daniela David et al, 2021). More specifically, the most common type of headache related to muscle tension is known as tension type headache (TTH). According to the Medicine Line Plus explains that TTH “is caused by tight muscles in [the] shoulders, neck, scalp, and jaw, it may be related to stress, depression, anxiety, or holding [someone’s] head and neck in an abnormal position” (Creek, 2019). TTH is seen to have a greater effect on adolescents than adults. According to researchers from Sapienza University, adolescents with TTH and headaches in general “may be

at greater risk [for] developing both further physical problems in adulthood and psychopathological problems such as anxiety and depression" (Baglioni et al, 2023).

Another symptom that develops muscle tension is having bad posture. Bad posture is when someone's spine is in an abnormal position. When someone has bad posture, the "muscular imbalance causes some muscles to be in a constant state of contraction while other opposing muscles remain weak and overstretched, which leads to pain" (Erin M. Friend, 2015). In a study about prevalence of bad posture in children, a group of research's screened 5 thousand plus students about bad posture. Their data showed "the overall prevalence of incorrect posture in children and adolescents was 65.3%" (Yang et al, 2020). Yang's study highlighted the incline of bad posture in adolescents recently compared to adults. Furthermore, "previous studies have shown that the bad posture in adulthood is often formed from childhood" (Louw et al., 2007). As younger generations develop bad posture earlier, they cause more problems in their adult life. Some reasons why bad posture in adolescents is increasing is because of the use of technology like seen in tech neck syndrome. Another aspect is that adolescents are in a growth spurt, which makes it more likely for teens to develop abnormal posture. Additionally, having bad posture over an extended period of time can harm other physical aspects of someone's body. For example, "reduce cardiorespiratory efficiency, decrease vital capacity of lungs, low back pains, and the displacement of internal organs" (Yu et al., 2002). These problems lead to further problems and act like a domino effect.

Mental health factors

These previous factors mentioned before, and other physical factors caused by muscle tension, all eventually lead to stress or stress-related disorders. When the body is under a lot of stress or is in a stressful environment, it activates "the body's "fight or flight" response activates"

(Ansari, 2024). This is a defense mechanism that is used by the body to protect itself from stress. The nervous system protects itself by putting “additional pressure on the blood vessels, which results in reduced blood flow to the muscles. This can cause muscle tension and pain” (Morrison and Cirino, 2019). The never-ending cycle mentioned earlier-if someone's stressed they get muscle tension and vice versa- causes other problems to rise, like effecting how someone functions.

Muscle tension also affects someone's cognitive ability, Mi Hu and Xing Wang, researchers in physical educations, found “a large-scale cross-sectional study [that had] a significant positive correlation between increased muscle strength and enhanced cognitive function” (Hu and Wang, 2025). The research indicated that muscle tension impacts cognitive function, and since muscle tension also causes stress, it can also disturb the mind affecting someone’s cognitive ability. When someone gets stressed “both cortisol and norepinephrine [a hormone and neurotransmitter that plays a role in the body’s stress response] have negative effects on cognitive function” (Phyllis Zee et al, 2024). Cortisol and Norepinephrine are also the hormones that appear in the “fight or flight” reaction caused by the nervous system. Being in a “constant state of alertness [like seen in the fight or flight], can impair cognitive abilities, making it harder to focus, make decisions, and regulate emotions” (Zee et al, 2024). In addition, an adolescent's cognitive ability is typically more affected than adults. Since adolescents “are in a critical period of brain plasticity. This heightened plasticity means that the brain is more impressionable, making it more vulnerable to negative experiences, such as chronic stress” (Perica & Luna, 2023). Since teens are growing and have lots of hormones developing, they have become more vulnerable “because their bodies are already experiencing extreme

hormonal shifts while they also go through shifts in their identity and dynamics" (Loker and Strain, 2025).

Prior research

There has been research done that sees the correlation of how stressed muscle cause mental problems to arise. In a study conducted by Mohammad Ahmed and other researchers, who attended Florida's Institute of Technology and Mississippi state university, tested how different states of mind affect the trapezius region. The participants were put under 5 minutes of stress and then they took a questionnaire. After they had to do 10 minutes of meditation, and then they ended with 5 minutes of data collection of using Electroencephalography and muscle sensors on the trapezius to see how they react. Once the study was done, they found that "low-frequency EMG features were particularly effective in detecting stress. This suggests that certain patterns of muscle activity in the trapezius region are indicative of stress levels" (Ahmed et al, 2024). Low-frequency EMG shows that when the brain is under stress, the trapezius would show signs of muscle fatigue. This further shows how stress is an indicative of muscle tension and there is a correlation between the two. However, the study was done on a demographic of 18–30-year-olds with no injuries. Additionally, a lot of researchers say that using exercise helps reduce both stress and muscle tension. Senthil Selvam and Sundaram, two PhD professors in India researched how to improve tension type headaches and help reduce stress levels by using muscular relaxation exercises or yoga. They did the study for 30 days; the participants either did muscular relaxation exercise or yoga for around 30 minutes a day. Although these exercises didn't focus on the trapezius, they looked at the neck, forearms, shoulders, face, and hands. The researchers "found that both groups show improvements in reducing Tension Type

Headaches" (Sundaram and Selevam, 2019). This research helped show that doing exercise can improve the mobility in the body thus reducing stress and the overall health of the individual. However, the age of the participants was between the ages of 25-30. In another study they also used Progressive muscle relaxation exercises as a form of therapy to see how it impacts people over the age of 20 with anxiety. They asked 16 participants to do a pre-test with a Hamilton anxiety rating scale, then they did 20-30 minutes of progress muscle relaxation therapy. Then they would answer the same questions as the pre-test in the post-test. They found "this study indicates the effectiveness of progressive muscle therapy in improving the patient's state of relaxation both psychologically and physiologically" (Syisnawati et al, 2022). This article proves that using exercises helps not only relax the body but also the mind.

Research Gap

In the research mentioned previously they look into the connection between physical problems like muscle tension and stress, and it proved that these two things are connected. However, these studies were all done on older individuals around 20 or older. Furthermore, other studies that focus on muscle and stress are also usually conducted on adults. On top of that, most of the studies use methods like yoga or muscular relaxation exercise and haven't used physical items like massage rollers. Comparing a physical item to an exercise can also help see the difference between the two and which one is more effective. So, this leads to the question, how can reducing muscle tension in high school students by either using a peanut message roller (PMR) or yoga, impact their stress levels and help potentially reduce their stress? Using different methods like massage rollers and yoga, we are trying to minimize the cycle of stress and muscle tension and all the problems that come with both of those variables,

like physical problems. We predict that group C will have the best outcome because they are using two exercises rather than one. Research shows that using a physical item and an exercise to relieve pain is more impactful because they work hand and hand. Exercise stretches the "myofascial release works directly on [muscle knots], applying controlled pressure to relieve tension and improve blood flow" (Awebber, 2014). Massage rollers help get areas the yoga can't, experts on rehabilitation at Go Physical Therapy, claim that "this hands-on technique applies targeted pressure to tight muscles and connective tissues, helping to release tension and promote relaxation" (practicepromossecure, 2025). With this information, we hypothesize that group C will decrease stress levels the most.

Methodology

Data collection process

This research was conducted between March and May of 2026. To begin the research, flyers were posted online to recruit participants. The flyers were posted on social media because that's where most adolescents spend their time on. So, by using social media we can gather participants of that demographic more effectively. Since we are working with underaged individuals in 11th and 12th grade, we made sure to get approved by the school board to ethically conduct research on teens. Furthermore, on the bottom right of the flyer, a QR code was added. This QR code went to a screener survey, the survey was done Microsoft 365 forms. As soon as they entered the survey, a consent form was provided; both the participant and their parents' consent were required in order to procced with the survey. Once they continue the survey, they were asked various questions regarding what grade they are in, the school they attend, stress levels, availability, etc. If they said yes to those questions, they were asked for consent again

from both the parent and them. Then, they were requested to provide their email, this makes the research private because the survey is anonymous until they gave me their information. We recruited 9 participants, and put three individuals into one of the 3 groups. Three were added to group A which did yoga, group B used the PMR, and group C did both. Since we do not have a control group, this is a quasi-experimental study. This study will be done similarly to the muscular relaxation vs yoga study mentioned previously, however, we used physical item and an exercise because of the gap we found. Additionally, we added one more group to see if combining the two methods had a better outcome. This research study will take 3 weeks because although prior research did their study for around a month, this had to be altered to not interfere with students' academic schedule. With massage rollers, a change happens in just a couple of minutes, but if they want to improve their "stress, general tension, or mild soreness from sitting too long or overdoing a workout, one to three sessions can provide noticeable results" (Momentume spine & sport physiotherapy). With yoga, this article from the Idaho sports medicine institution states that "people reported seeing an increase in flexibility 2-4 weeks after beginning their practice" (Idaho sports medicine institute, 2022). That's why the study was done for 3 weeks, to impact the students but not disrupt the students' academics.

Upperclassmen stress

In this study, we are looking for junior and senior participants because they typically show more signs of stress, which means they are more likely to have muscle tension. In a Statista article, it mentions that "30% of kids and young adults aged 14 to 25 cited that getting high grades affected their mental health" (Statista & Blue Shield of California, 2023). The article highlights how schoolwork affects high school students using data. Moreover, students who are usually more stressed are upperclassmen. This happens because upperclassmen are more

involved with sports, community service, or have jobs. Additionally, juniors and seniors must worry about their future, college preparation and are in this transition from teenager to adult and have adult responsibilities. A news article from the student news of liberty high says that “junior year is the last year colleges will see on students’ high school records. With tests like the SAT and ACT, students are under tons of academic stress to perform well, which can lead them to overwork themselves with studying and work” (Stewart, 2024). Furthermore, seniors are stressed because they are trying to apply for college, making big decisions for their future, getting good grades, and at the same time finding time to socialize. An article from collage data, did a questionnaire to see what the biggest factors are stressing high school seniors out. They found that 52 percent of students said applying to college in general was their biggest stress factor. A student from the same article stated, "[they were] incredibly stressed about not getting into the college [they] wanted, feeling like a failure, not being ready for college, comparing [themselves] to peers, and transitioning away from home" (CollegeData, 2025). Although, other grade levels can have personal problems that affect their stress too, upperclassmen have a lot more on their plates like seen in these articles. That is why we are looking for participants who are upperclassmen.

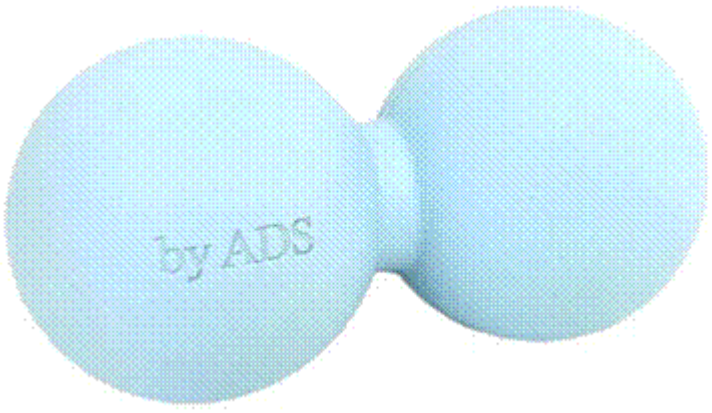
Peanut massage roller (PMR)

One of the methods used will be a PMR. The reason this study is focusing on PMR is because foam rollers concentrate on rolling in "areas [such as the] lower back, neck, [which] simply isn't enough dense muscle tissue in those areas for rolling to be safe and effective" (Baum, 2024). While a PMR focuses on the "neck, feet (for plantar fasciitis), forearms, and for individuals with smaller body frames who find larger rollers too bulky" (Zuleger, 2025). It also

makes it more safe to use since it doesn't hit the bones in an awkward position like the foam roller, because the PMR is designed for the neck and spine region, making it safe to use.

Figure 1

Peanut massage roller



Note: The illustration on the PMR shows what it looks like; however, it is not the exact one that was used in this study.

The participants used a small PMR provided by a northern Virginia high school administrator team. Throughout the 3 weeks, they watched a video to help guide them. The video was found on YouTube titled “How to Use a Peanut (Self Myofascial Release) | Dr. Evan Schwindt | MYo Lab Health & Wellness” by MYo Lab Health & Wellness. MYo Lab health & wellness has clinics with professionals who do physical therapy, chiropractor and other physical activities around the U.S. and Canada. In the video, it explains what a PMR does and how it works, then it shows the audience how to use a PMR correctly. Additionally, they were also notified through email, explaining how and how not to use the PMR based on what the athletic trainer from a northern Virginia high school said. This was done to minimize the risk of the participants.

Yoga

Yoga will be the next method used. Yoga helps relieve muscle tension because “unlike regular exercise, yoga combines breathing techniques and slow, gentle movements and holds, allowing [the person to relax their] muscles” (Fairview rehab & nursing home, 2024). Additionally, Maya L. Thompson a woman who works in the department of physical education, states that “yoga’s benefits for muscle recovery stem from its ability to increase blood circulation, stretch tight muscles, and reduce inflammation” (2024). Using yoga helps reduce muscle strain, which helps heal other parts of the body.

The participants will be watching a video, " Yoga for Neck, Shoulders, Upper Back | 10-Minute Yoga Quickie” by Yoga with Adriene, she has 20+ years of experience doing yoga. This video will help them do the correct yoga positions to relieve pain near the trapezius muscles. Like the PMR groups, they were also sent an email explaining how to follow the yoga video correctly.

Data analysis

To measure if the methods would work, we used a perceived stress scale 10-questionaire. The Perceived stress scale has been used since 1983, “to measure the degree to which situations in one's life are appraised is stressful" (Cohen, 2004). The one being used in this study is from the State of New Hampshire Employee Assistance Program. These questions were copied from the State of New Hampshire Employee Assistance Program PDF and were added into a Microsoft form Likert scale type survey. Some of the questions asked were, how often have they been upset because of something that happened unexpectedly? How often have they felt nervous and stressed? They answer these questions by selecting 0-never, 1-almost never, 2-sometimes, 3-fairly often or 4-very often. Once they have answered the 10 questions, they move onto section 2. In section 2 it asks them to go back and change the scores

from questions 4, 5, 7, and 8. If they got 4, it changes to 0, 1 change to 3, 2 stays the same, 3 changes to 2, and 4 changes to 0. Once they have done that, they calculate their score and put their total in the Likert scale survey. If their score was between 0-13, their stress level was low. If they got 14-26, they had moderate stress levels and if their total score ranged from 27-40, they had high stress levels. With the total score, we would see if their stress level are high, moderate, or low, and how the scores changed throughout the 3 weeks using descriptive statistics such as using standard deviation, mean, mode, etc. The last question asked was for the date, this is asked in order to keep track of what stress score they got on the specific day. Asking for the date helped analyze the data more efficiently, so we could see when a change happened. The participants would take the perceived stress scale before and after each exercise session. In a prior research study, researchers wanted to see how a coconut shell stress relief pillow helped reduce the stress levels of individuals over the age of 18. They also used a “self-stress assessment” to measure the stress levels of each participant before and after the treatment. During each session” (Chunprawat et al, 2025). We used the same format to measure the stress levels of the participants.

Limitations

Some limitations that could affect the study are interest bias; people who are interested in the study can already believe that this will help cure their muscle tension. What should have been done was asked prior to muscle tension each participant had if any to know their history. This could have given us more insight if the participant had prior bias and helped prevent bias. This also could have helped to see if this study was going to help them or not. Additionally, because time was thin, participants that knew the researcher were asked to take the eligibility form, since no one was participating. This influenced the demographic that did the survey

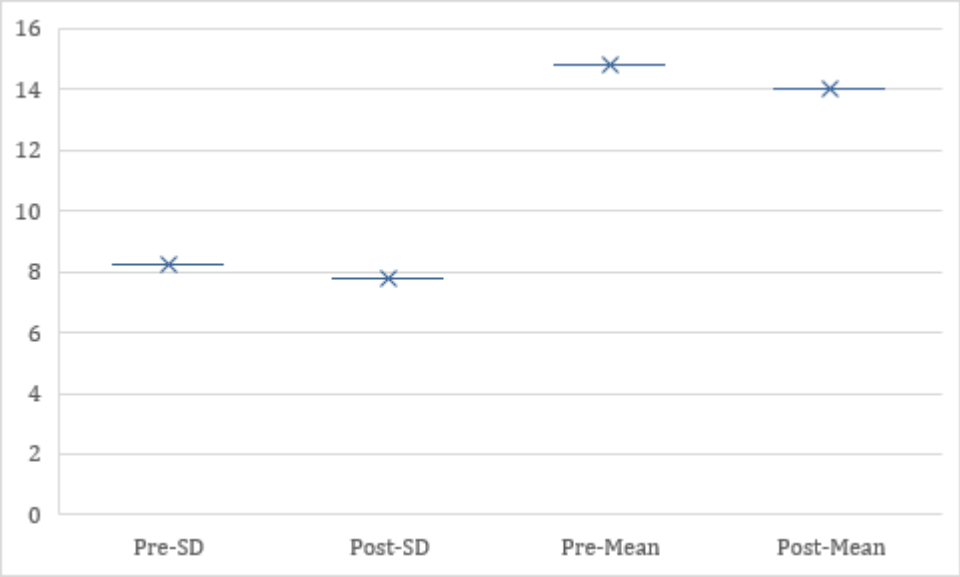
because most of the people who did the study were mostly juniors. Moreover, this could influence the outcome of the data and impact on how accurate the data is. On top of that, the time the study was done when people were doing SAT preparation and SOL. Which was a good and bad thing, because it meant they were more stressed and could be studied better. However, it also meant people are not going to be available to do the study.

Results

Originally, this research aimed to collect 164 responses from the PSS, however, only 53 were collected at the end of the 3 weeks. The pre, post, and total numbers for standard deviation (SD) which is how much scores vary, the mean (average), the median, the mode, the maximum, and the minimum were calculated from the sample size, which is 53. Additionally, all the numbers that will be mentioned are going to be rounded to the hundredths place. The median was 19, the mode was 8, the maximum score was 34 and the minimum was 4. Those numbers were calculated using all the PSS scores from the whole 3 weeks. The pre-SD= 8.26, the pre mean= 14.82, these numbers were gotten from the first day scores on the PSS. Moreover, the post-SD= 7.80, and the post mean=14, to get these numbers the PSS scores from the last day of the 3 weeks were used. The total SD was 7.70 and the total mean was 15.74.

Figure 2

Total pre and post results from stress scores

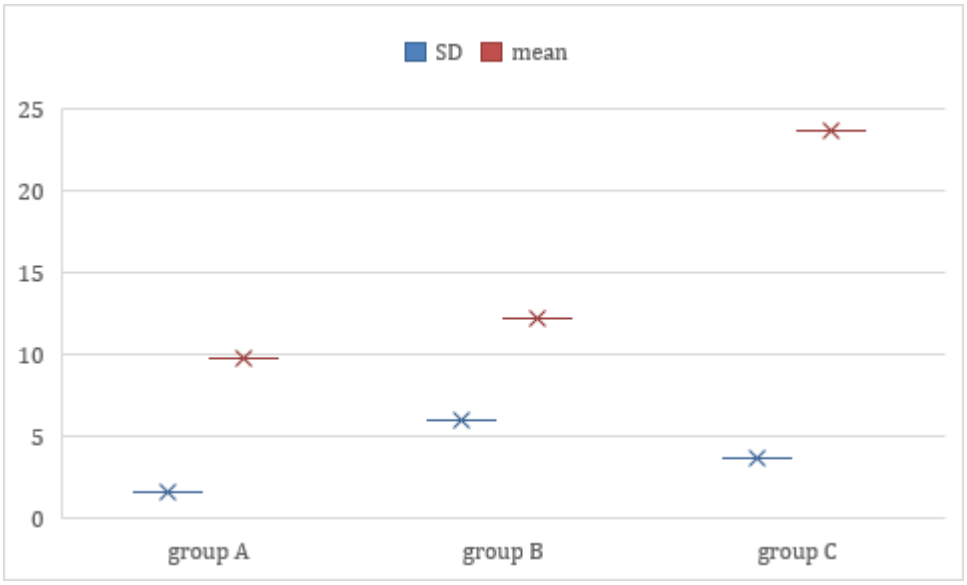


Note. The total data collected being seen in the first week (pre) compared to the last week (post) and seeing how the change occurred over time.

The SD and mean were also calculated for each group (A, B, and C). Due to the variation from the data collected, only the completed PSS scores were included in this descriptive analysis. For the yoga group (A), for this group the sample size was 11, the SD=1.60; the mean= 9.82. Group B was the PMR group, 16 was the sample size for this group, the SD= 5.99, the mean=12.19. Lastly, group C was both the massage roller and yoga; the group sample size was 19. The SD= 3.76 for this group and the mean= 23.63.

Figure 3

Total SD and mean of each group

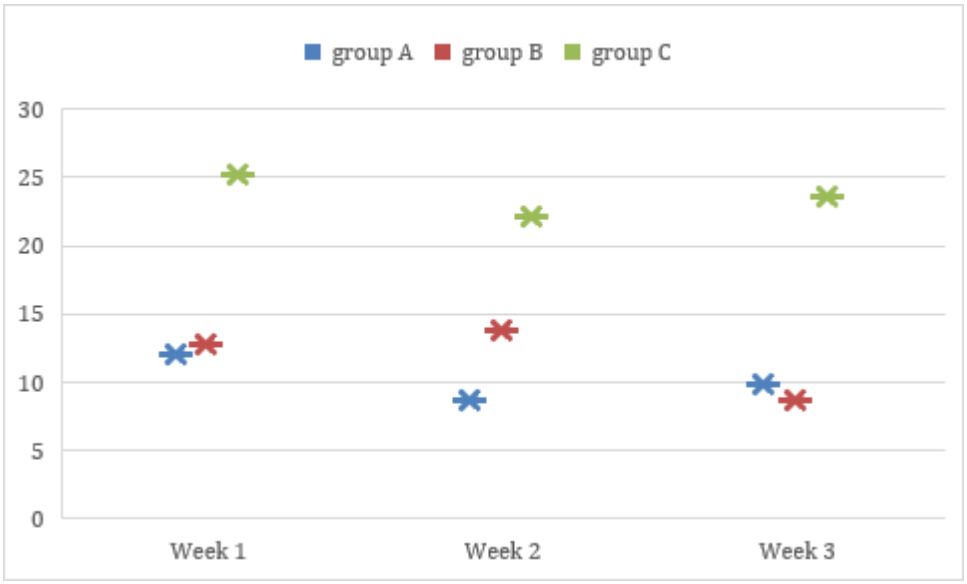


Note. The total variation (SD) and the average (mean) of each individual group being compared.

Additionally, the mean/average stress scores were calculated each week for all 3 groups, only the ones who completed the study were included.

Figure 4

Average stress score (mean) of the 3 groups throughout the study



Note. box and whisker graph depicting the mean of each of the groups over the spam of 3 weeks.

For group A the mean for week one was 12, for week two it lowered to 8.75 and week three it ended at 9.8. Group B had an average of 12.83 for the first week, in week two it went up to 13.83, and for week three is declined to 8.75. Lastly for group C in week one the mean was 25.17, the mean went down in week 2 to 22.17 and week three was increased slightly to 23.57.

Discussion

Throughout the study some of the participants did not do the exercises at all or stopped doing the exercises in the middle of the study. Out of the nine participants only seven opened the PSS survey and did it or some of it, and out of the seven only three completed the 3 weeks. This impacted the research because it affected how the data could be analyzed; since one group had less participants and another group had more, it made the data unbalanced. Additionally, the data they provided couldn't be fully analyzed to see if it helped reduce the students' stress levels. One reason why this could have happened was because the study was conducted during SAT and SOL season, which meant many of the participants were too busy because they were juniors. Since many did not do the study, only the ones who completed the entire study were added to the descriptive data. However, for the pre and post data all the scores were included. In addition, because time was running out participants who were genuinely struggling with muscle tension or stress couldn't be picked because no one was interested. Future researchers might want to find people who are interested in the research. Something future researchers could do is ask during the screen survey for people to take a quick PSS and then pick the people who have higher stress levels to participate, but this can

cause some interest bias if they wanted to try that method out. Furthermore, we tried to remind the participants to do the exercises in between the 3 weeks, but some may not have checked their email or forget once they got home. That was something we could not control since we tried to inform the participants. Another thing future studies might want to consider is using a different PSS because the one used was not specific to what we wanted to analyze. They should pick a PSS that focuses on short-term stress rather than long-term stress. The PSS used in this study included long term stress questions such as “in the past month”, although that part of the questions were removed it still implied how stress a person was during the last month. The data could have been more accurate if the PSS asked questions of stress in the moment or in the past week rather than a month.

While analyzing the data, we noticed that in the total data the stress levels seemed to go down. The scores received from the PSS stress level scores showed that most of the participants received low to moderate scores except for one high score. As the 3 weeks came to an end, even lower scores were seen, compared to the start of the 3 weeks, this is seen in figure 2. For the pre-SD and the post-SD, it decreased by 0.46. Even though the change was minimal, it still decreased, meaning the exercises helped. The difference between the pre-mean and the post-mean was 0.82, which means it also decreased. This gives us insight that because the participants had a positive reaction to the exercises, it further supports the claim from the prior research that relieving muscle tension can decrease the levels of stress in someone. With this information it also demonstrates that that claim is also consistent when done with adolescents.

When looking at the individual groups we realized the group who had the most change throughout the study was group B because their scores varied more. Out of the 3 groups, group

A had the lowest average stress score, 9.82. This insinuates that their scores were persistently lower and with a low SD score that means they had minimum change because their scores were already low and they just lowered even further. Group C had the highest average at 23.63. Since their participants showed more moderate stress scores-and even one high score-on the PSS compared to the other groups. This meant that just like group A, group C stress scores were consistent and didn't change except their stress scores were higher rather than low. Analyzing all of this, group B had the best outcome because their SD was the highest since what we are looking for is a change in the data and that the change is significant. Additionally, group B has a good mean in the middle, this demonstrates that it had an improvement that was just right because the mean was not too low or high and didn't stay in the same range. Group B's data matched what we are trying to prove which is that by relieving muscle tension we can relieve stress levels and improve them over time. Another reason why group B probably had the best outcome was because the participants were using a physical item which is more impactful than yoga. This is because physical things like foam and massage rollers use "myofascial release [which] works directly on [muscle tension], applying controlled pressure to relieve tension and improve blood flow" (your health, 2026). Since the body is receiving better blood flow it works better and it causes better mobility, better blood flow also helps reduce stress because "Exercise can help increase circulation, strengthen the veins, and reduce stress hormones" (laser vien center, 2023). This is most likely why group B had the most significant change that answered the research question. That goes against what we hypothesized in the beginning, but it was not far off because just like practicepromossecure said, physical items add pressure to tight muscle that stretching cannot target. Something else that could have influenced the results and why group C did not have the best results was because the

participant in group C had more stress than the participants in group B and there were also more participants in group B. That is probably why the data varied more and the mean wasn't too high compared to group C. In the future, researchers can find participants with similar stress scores. On top of that, future researchers should also look into what areas improve because of these methods, for example if they help them in their academic, personal, or social lives.

Conclusion

The methods conducted in this study ultimately answered the research question with the data showing that relieving muscle tension in adolescents does help reduce students' cortisol levels. The results of the pre-and-post data showed that in the end the stress scores declined. This further supported the previous studies that made this claim but also showed that it is consistent in other age groups too. Adding to that, using a PMR to relieve muscle tension by itself is the best way according to the findings, this was a different result than the one we hypothesized. The PMR showed a high variation throughout the 3 weeks, which decreased at the end and a mean that wasn't too high or low. More research should be done to see how these methods affect the students in different areas of their lives. While not perfect, this study helped justify the claim made at the beginning of this study. Adolescents who struggle with muscle tension or stress or even both can use PMR to help solve these issues and prevent them from continuing to impact their lives.

References

Ahmed, Mohammad, et al. “A Comprehensive Analysis of Trapezius Muscle EMG Activity in Relation to Stress and Meditation.” *BioMedInformatics*, vol. 4, no. 2, MDPI AG, Apr. 2024, pp. 1047–58, https://doi.org/10.3390/biomedinformatics4020058. Accessed 5 May 2025.

American Psychological Association. “Stress Effects on the Body.” *American Psychological Association*, American Psychological Association, 21 Oct. 2024, www.apa.org/topics/stress/body.

Alogan. “How Stress Affects the Brain | American Brain Foundation.” *American Brain Foundation*, 27 Aug. 2024, www.americanbrainfoundation.org/how-stress-affects-the-brain/?c_src=gg&gad_source=1&gad_campaignid=12376508796&gbraid=0AAAADiwIXYpOzmbxVoEgiL9FzRjUI_YA&gclid=EAIaIQobChMIzOPitOGNkQMV1UhHAR1Y2C0nEAAYASAAEgJtgfD_BwE. Accessed 16 Feb. 2026.

Awebber. “Learn How You Can Relieve Overworked, Sore or Tense Muscles – Cooper Aerobics.” *Cooper Aerobics*, 30 May 2014, www.cooperaerobics.com/blog/relieving-muscle-tension/. Accessed 28 Apr. 2026.

Baglioni, Valentina, et al. “Tension-Type Headache in Children and Adolescents.” *Life*, vol. 13, no. 3, Mar. 2023, pp. 825–25, https://doi.org/10.3390/life13030825.

Bizcor. “St. Louis Laser Vein Center.” *St. Louis Laser Vein Center*, 10 Apr. 2023, stlouislaserveins.com/2023/04/10/the-silent-killer-how-stress-affects-your-vein-health/. Accessed 25 Apr. 2026.

“Checking Your Browser - ReCAPTCHA.” *Nih.gov*, 2024, pmc.ncbi.nlm.nih.gov/articles/PMC5717808/#s4. Accessed 25 Apr. 2026.

Cleveland Clinic. “Muscle Stiffness: Causes & Treatment.” *Cleveland Clinic*, my.clevelandclinic.org/health/symptoms/25147-muscle-stiffness.

Cirino, Erica. “What Causes Muscle Rigidity?” *Healthline*, Healthline Media, 2019, www.healthline.com/health/muscle-rigidity.

David, Daniela, et al. “Text Neck Syndrome in Children and Adolescents.” *International Journal of Environmental Research and Public Health*, vol. 18, no. 4, Feb. 2021, p. 1565, https://doi.org/10.3390/ijerph18041565.

“Does Foam Rolling at Different Speeds Produce Different Effects?” *Flexibilityresearch.com*, 2024,www.flexibilityresearch.com/blog/does-foam-rolling-at-different-speeds-produce-different-effects. Accessed 25 Apr. 2026.

Eiland, L., and R. D. Romeo. “Stress and the Developing Adolescent Brain.” *Neuroscience*, vol. 249, no. 249, Sept. 2013, pp. 162–71,https://doi.org/10.1016/j.neuroscience.2012.10.048.

“Headache: MedlinePlus Medical Encyclopedia.” *Medlineplus.gov*, 2016, medlineplus.gov/ency/article/003024.htm.

How. “How Often Should You Do Yoga? Why 3x a Week Works Best | Heart + Bones Yoga – Heart + Bones Yoga.” *Heart + Bones Yoga*, heart+bones, 2025, heartandbonesyoga.com/resources/how-often-should-you-do-yoga-why-3-times-week-works-best/. Accessed 16 Feb. 2026.

“How Long It May Take to Notice Results from Massage Therapy.” *Momentum Spine & Sports Physiotherapy*, 3 Sept. 2025, www.mssphysio.com/results-from-massage-therapy/. Accessed 25 Apr. 2026.

Hu, Mi, and Xing Wang. “The Correlation between Muscle Strength, Inhibitory Function, and

Cognitive Function in Older Adults with Cognitive Impairment: Evidence from Resting-State Electroencephalography." *Frontiers in Aging Neuroscience*, vol. 17, June 2025, https://doi.org/10.3389/fnagi.2025.1574275. Accessed 21 Sept. 2025.

Ilias Ntoumas, et al. "Massage Positively Influences Daytime Brain Activity and Reduces Arousal State in Poor Sleepers: A Randomized Controlled Trial." *BMC Complementary Medicine and Therapies*, vol. 25, no. 1, BioMed Central, July 2025, https://doi.org/10.1186/s12906-025-05022-6.

"Learn How Long It Takes to Increase Flexibility in Yoga." *ISMI - Orthopedic Surgery, Sports Medicine, & Physical Therapy*, 6 July 2022, idsportsmed.com/learn-how-long-it-takes-to-increase-flexibility-in-yoga/. Accessed 25 Apr. 2026.

Li, Gao, et al. "The Impact of Different Muscle Relaxation Techniques on the Upper Trapezius and Its Relationship with the Middle Trapezius." *PubMed*, vol. 67, no. 4, National Institutes of Health, July 2024, pp. 225–32, https://doi.org/10.4103/ejpi.ejpi-d-24-00041.

Lone Star Neurology. "The Silent Threat: How Stress Affects the Nervous System." *Lone Star Neurology*, 25 June 2024, lonestarneurology.net/others/how-stress-affects-your-nervous-system/.

Ma, Yixuan, et al. "Relationships between Muscle Strength, Lung Function, and Cognitive Function in Chinese Middle-Aged and Older Adults: A Study Based on the China Health and Retirement Longitudinal Study (CHARLS)." *Journal of the Formosan Medical Association*, Elsevier BV, Apr. 2024, https://doi.org/10.1016/j.jfma.2024.04.001. Accessed 22 Nov. 2024.

Nakazato, Tomas, et al. "Chronic Neck Pain Prevalence before and after COVID-19 Restrictions

and Its Relationship with Digital Device Screen Viewing: A Population Study." *Annals of Rehabilitation Medicine*, vol. 48, no. 2, Korean Academy of Rehabilitation Medicine, Apr. 2024, pp. 124–34, https://doi.org/10.5535/arm.230030.

Perica, Maria I., and Beatriz Luna. "Impact of Stress on Excitatory and Inhibitory Markers of Adolescent Cognitive Critical Period Plasticity." *Neuroscience & Biobehavioral Reviews*, vol. 153, Oct. 2023, p. 105378, https://doi.org/10.1016/j.neubiorev.2023.105378.

Picavet, H. Susan J., et al. "A Widening Gap between Boys and Girls in Musculoskeletal Complaints, While Growing up from Age 11 to Age 20 - the PIAMA Birth Cohort Study." *European Journal of Pain*, vol. 25, no. 4, Jan. 2021, pp. 902–12, https://doi.org/10.1002/ejp.1719. Accessed 4 July 2021.

Practicepromossecure. "Relieving Muscle Tension: The Benefits of Soft Tissue Manipulation in Manual Therapy - Go PT (Gretna)." *Go PT (Gretna)*, 20 Mar. 2025, gopt.us/dynamicpt/relieving-muscle-tension-the-benefits-of-soft-tissue-manipulation-in-manual-therapy/. Accessed 28 Apr. 2026.

Rush, Tom. "Active Release Technique Uses and Benefits." *Healthline*, Healthline Media, 14 May 2018, www.healthline.com/health/active-release-technique#takeaway.

Salameh, Muna A., et al. "Prevalence of Text Neck Syndrome, Its Impact on Neck Dysfunction, and Its Associated Factors among Medical Students: A Cross-Sectional Study." *Work*, IOS Press, June 2024, pp. 1–9, https://doi.org/10.3233/wor-230678.

Senthil Selvam. "Effects of Progressive Muscular Relaxation Exercises vs Yoga on Tension Headache: A Comparative Study." *Academia.edu*, 2019, https://doi.org/10.21275/ART20196029. Accessed 16 Feb. 2026.

State of New Hampshire Employee Assistance Program. *Perceived Stress Scale*. 1983,

www.das.nh.gov/wellness/docs/percieved%20stress%20scale.pdf.

Syisnawati, Syisnawati, et al. “Effectiveness of Progressive Muscle Relaxation Therapy on Anxiety by Using Model Approach Stress Adaptation and Interpersonal.” *Malaysian Journal of Medicine and Health Sciences*, vol. 18, no. SUPP3, 2022, pp. 141–46, medic.upm.edu.my/upload/dokumen/2022022317312628_1001.pdf.

The. “Your Health Organization.” *Your Health Organization*, 13 Nov. 2024, www.yourhealth.org/blog/the-benefits-of-myofascial-release-techniques. Accessed 25 Apr. 2026.

Top Doctors. “Muscle Tension: What It Is, Symptoms and Treatment.” *@Topdoctors_uk*, 2015, www.topdoctors.co.uk/medical-dictionary/muscle-tension/.

“What Is a Peanut Foam Roller? | Tiger Tail USA.” *Tiger Tail USA*, 23 Sept. 2025, tigertailusa.com/what-is-a-peanut-foam-roller/. Accessed 16 Feb. 2026.

“What Is a Peanut Massage Ball Roller and Why Do You Need One?” *AcupointUSA*, 2023, www.acupointusa.com/blogs/news/why-do-you-need-a-peanut-massage-ball-roller?srsltid=AfmBOop6XD1zEy41lXmh7Ojzi7XX76wM0WF4RPjQCrF6F2F3EKGKWzRC. Accessed 16 Feb. 2026

“What Is Muscle Tension and Trembling in Teens?” *Mission Prep Teen Treatment*, 28 Oct. 2025, missionprephealthcare.com/mental-health-resources/physical-symptoms/muscle-tension/. Accessed 25 Apr. 2026.

Yang, Lei, et al. “Prevalence of Incorrect Posture among Children and Adolescents: Finding from a Large Population-Based Study in China.” *IScience*, vol. 23, no. 5, Apr. 2020, https://doi.org/10.1016/j.isci.2020.101043.

Zieliński, Grzegorz, et al. “The Relationship between Stress and Masticatory Muscle Activity in

Female Students." *Journal of Clinical Medicine*, vol. 10, no. 16, Aug. 2021, p. 3459, https://doi.org/10.3390/jcm10163459.

Appendix A

screen survey and flyer


ARE YOU INTERESTED IN PARTICIPATING IN A STUDY ABOUT MUSCLE TENSION AND STRESS RELIEF?
LOOKING FOR SENIORS AND JUNIORS
SCAN THIS QR CODE

Consent

1. Woodbridge Senior High School AP Capstone Research: The purpose of this research is to see how different methods relieve tension in the trapezius region. This study aims to learn more about the correlation of different muscle regions in connection with stress. The goal of this research is to decrease tension in the trapezius muscles so that stress levels in upperclassmen can improve.

   Requirements for Participation: -Must be a Woodbridge Senior High School junior or senior (11th or 12th grade) -Must be between the ages of 15-18 -Advanced students

   Questions do include personal questions about levels of stress, but participants may x-out at any time. This survey takes approximately less than 3 minutes. If you Qualify additional information and consent will be provided.

   Questions or concerns: Contact Andrew McCarthy, Woodbridge Senior High School AP Research Teacher Email: mccartae@pwcs.edu Phone: 703-497-8000. If you need support or have personal concerns, you may also contact your school counselor. *

   - ○ Yes, I am under 18 years old and my parents/guardians and I consent to participate in this survey
   - ○ No, I am under 18 years old and my parents/guardians and/or I do not consent to participate in this survey
   - ○ Yes, I am 18 years or older and consent to participate in this survey
   - ○ No, I am 18 years or older and I do not consent to participate in this survey

Eligibility

2. Are you a Woodbridge Senior High School student?
   - ○ Yes
   - ○ No

3. Are you a senior or junior (12th or 11th graders)?
   - ○ Yes
   - ○ No

4. Do you take at least 1 AP/DE course?
   - ○ Yes
   - ○ No

5. On a scale of one to ten, how stressed are you?

0	1	2	3	4	5	6	7	8	9	10

Not at all stressed — Extremely stressed

6. Are you interested in participating in yoga and/or message roller sessions at home three days per week for 3 weeks?

- ○ Yes
- ○ No

7. Will you be available to do this research?

- ○ Yes
- ○ No

Information

8. If participating in this study with parental/guardian consent, your child will do different methods focused on specific muscles to relieve stress for 3 weeks, 3 times a week. This includes either participating in video-led beginner yoga (https://www.youtube.com/watch?v=X3-gKPNyrTA&t=462s) and/or using a massage roller (https://www.youtube.com/watch?v=mnM2zhSTpvo). And as mentioned earlier, the participant may stop at any time. The session time takes approximately 3 weeks at home. The purpose of this research is to see how different methods used on muscle tension can impact stress levels of adolescents. These sessions will be conducted February-march 2026.

   All answers, responses and participation will stay private only to the researcher. Neither names nor any identifying information will be disclosed. Data will be stored safely in a password protected account and used only for this study. If any personal information is collected, it will be used only for this research. It will be stored securely and permanently deleted after the research is completed and finalized.
   *

- ○ Yes, I am under 18 years old and my parents/guardians and I consent to participate in this survey
- ○ No, I am under 18 years old and my parents/guardians and/or I do not consent to participate in this survey
- ○ Yes, I am 18 years or older and consent to participate in this survey
- ○ No, I am 18 years or older and I do not consent to participate in this survey

9. If you are interested in participating in this research, please leave your school email, and the researcher will respond with further instructions.

Please enter an email

Appendix B

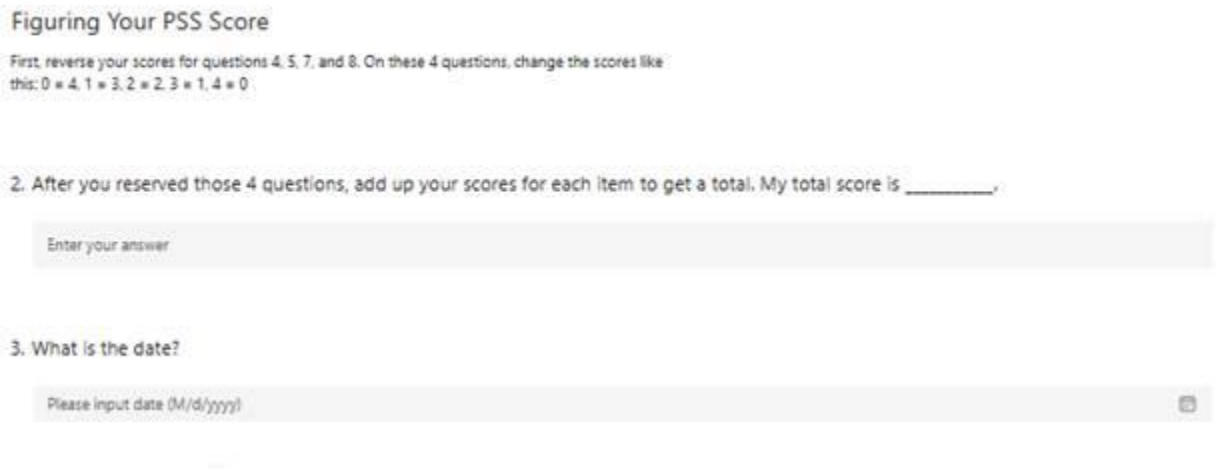
Survey questions- PSS survey.

for each question choose the following

0 never 1 almost never 2 sometimes 3 fairly often 4 very often

1. Question *

	0 Never	1 Almost never	2 Sometimes	3 Fairly often	4 Very often
how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
how often have you felt nervous and stressed?	○	○	○	○	○
how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
how often have you felt that things were going your way?	○	○	○	○	○
how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
how often have you been able to control irritations in your life?	○	○	○	○	○
how often have you felt that you were on top of things?	○	○	○	○	○
how often have you been angered because of things that happened that were outside of your control?	○	○	○	○	○
how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○


Figuring Your PSS Score

First, reverse your scores for questions 4, 5, 7, and 8. On these 4 questions, change the scores like this: 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0

2. After you reserved those 4 questions, add up your scores for each item to get a total. My total score is _____.

Enter your answer

3. What is the date?

Please input date (M/d/yyyy)

Appendix C

Actual data numbers (unrounded).

Mode-8

Median-19

Mean all scores= 15.735849056604

SD all scores= 7.6965300458069

Pre SD= 8.2561272012752

Pre mean= 14.818181818182

Post SD= 7.8010988237006

Post mean= 14

Mean for peanut roller= 12.1875

Sd for peanut roller= 5.9913131560062

Mean for week 1- 12.833333333333

Mean week 2- 13.833333333333

Mean week 3- 8.75

Mean for yoga= 9.8181818181818

Sd for yoga= 1.6011359603845

Mean week 1- 12

Mean week 2- 8.75

Mean week 3- 9.8

Mean for both= 23.631578947368

Sd for both= 3.7595881322263

Mean week 1- 25.166666666667

Mean week 2- 22.166666666667

Mean week 3- 23.571428571429