

# Best Effect of Progressive Muscle Relaxation (PMR) on Children: A Systematic Review

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**Keywords:** Progressive Muscle Relaxation, Children, Systematic Review.

**Abstract:** Objectives: Progressive Muscle Relaxation (PMR) showed good benefit in adult such as reduction stress, this systematic review to synthesis evidence on progressive muscle relaxation effect in children and investigates minimum ages to started the PMR. Methods: A literature search was conducted on ProQuest, EBSCOhost, ScienceDirect, and SpringerLink. The systematic review consisted of retrieving articles published between 2008 until 2018, using the keywords “progressive muscle relaxation” and child or pediatric or adolescent. Results: Overall more than 500 potential articles were screened, of which 10 were eligible. All of articles showed PMR is significant to reduce stress and anxiety of children, 50% articles showed the participant’s is school age and adolescent with minimum age is 4 year or older. Conclusions: progressive muscle relaxation is good technic to reduction stress in children, also increased good mood and attention of children. In closing, further evidence is needed to delineate the obstacle of doing PMR in children, by qualitative or quantitative research especially in Indonesia.

## 1 INTRODUCTION

Stress is a result of discrepancy between individual reaction to difficulties or limitations and his capability of managing and overcoming important situations. Children’s strategies to adapt with stress depend on their abilities as well as their accomplishment to use the abilities. The stressor causes emotion changes on that raise stress (Terzian, Moore, & Nguyen, 2010). Stress becomes the main cause of negative behaviour in childhood. The negative behaviour includes anxiety, depression, memory and language disorder, and reduction of academic ability (Evans & Schamberg, 2009).

Children frequently encounter difficulty to adapt stress., Furthermore, when they feel difficult to express their stress, they will experience emotion changes, behaviour, or physical disorder. other physical disorders include increase of muscle tension, headache, stomach illness, eating and sleeping disruption, and lack of energy. The emotion changes include nervousness, worry, unenthusiastic feeling, anger, revenge to their peer, shyness or self-isolated behaviour, powerlessness, and desperation. The behaviour changes include bad habit of eating and weight loss/gain in a short time (Terzian et al.,

2010).

Relaxation is one of effective non-pharmacological techniques to decrease stress because it influences mental and physical conditions, depression, mood, anxiety, and self-blaming. Several studies prove that well-ordered and consistent relaxation can decrease stress. Therefore, nurses are expected to be able to provide education of relaxation benefits for patients because the education is cheap and easy to practice (Gorji, Davanloo, & Heidarigorji, 2014).

One of the relaxation techniques is Progressive Muscle Relaxation (PMR). Jacobson (1976) explains that relaxation to several muscles can be practiced by making the muscles maximally strain, and then loosening it until the muscle is relaxed. Jacobson finds that systematic strains and slow extrication on some muscles enable someone to feel different sensation of muscle strain and relaxation. This process makes someone experience deep relaxation. Jacobson suggests that relaxation and contraction are successively conducted in sixteen muscle groups. However, generally PMR is practiced by adults.

## 1.1 Purpose

This systematic review proposes to analyze the influence of PMR on children's decrease of stress and to investigate the right time to start PMR on children.

## 2 METHODS

The systematic review will be reported in line with the guidelines from the Cochrane Handbook of Systematic Reviews of Interventions (versión 5.1.0) (Higgins, J. P. T., Green, S., & Collaboration, 2011), also used the recommendations of the PRISMA statement (Urrútia, G., & Bonfill, 2010).

### 2.1 Criteria of Article Selection

The selected articles were articles employing true-experimental method or quasi-experimental design which analyzed the influence of PMR on the decrease of stress, anxiety, or other positive aspects such as increasing attention or interest. The selected articles were articles written in English and published in the last 10 years, and articles with children as their population

### 2.2 Search Strategy

The complete search was conducted in four databases: ProQuest, EBSCOhost, ScienceDirect, and SpringerLink. The search was conducted from October to November 2018, with the keywords progressive muscle relaxation, child, paediatric, and adolescent

### 2.3 Articles Selection

After searching articles in several databases, the first step of selection was to read titles and abstracts of the articles. Then, the chosen articles were verified by two reviewers. The two reviewers discussed to select the articles by considering inclusive and exclusive criteria. The complete selection process is presented in Fig.1.

Finally, 10 appropriate articles for the inclusive and exclusive criteria are selected.

## 3.1 Article Characteristic

The total respondents of the articles are 870 children. Six articles focus on the effect (time duration and frequency) of decreasing the level of stress and anxiety (Chan et al., 2015; Hashim & Zainol, 2015; Manjushambika, Prasanna, Vijayaraghavan, & Sushama, 2017; Mason, Burkhart, & Lazebnik, 2018; Olmedilla-zafra, Rubio, Ortega, & García-mas, 2017; Srilekha, Soumendra, & Chattopadhyay, 2013), 3 articles analyze the effect of PMR on increasing attention/interest, the ability to answer the questions, and language retardation (Chan, Sze, Siu, Lau, & Cheung, 2013; McKenney, Broach, & Mullen, 2018; Murray, Scott, Connolly, & Wells, 2018), Meanwhile, 1 remaining article discusses the impact of PMR on children's headache (Jong et al., 2018).

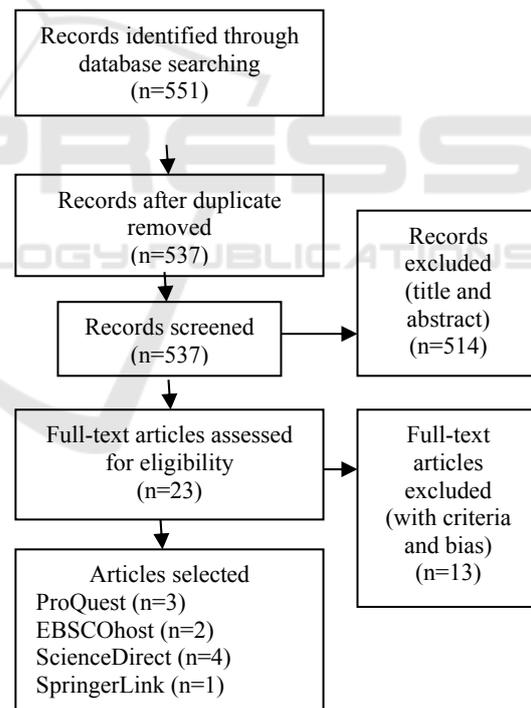


Figure 1: Article Selection.

## 3 RESULT

The result of the search reveals that 551 articles are found, and only 23 complete articles are analyzed.

There are 5 articles employ true-experimental design (Chan, Sze, Siu, Lau, & Cheung, 2013; Jong et al., 2018; Manjushambika, Prasanna, Vijayaraghavan, & Sushama, 2017; Murray, Scott, Connolly, & Wells, 2018; Olmedilla-zafra, Rubio, Ortega, & García-mas, 2017), 4 articles employs

quasi-experimental design (Chan et al., 2015; Hashim & Zainol, 2015; McKenney, Broach, & Mullen, 2018; Srilekha, Soumendra, & Chattopadhyay, 2013), and 1 article employs cohort method (Mason, Burkhart, & Lazebnik, 2018). The explanation of selected articles is presented in Table 1.

The analysis of selected articles reveals that the articles have discussed the procedures of PMR, duration and sessions to practice PMR are different, and PMR possibly influences the result. The explanation of how the duration and frequency session to practice PMR can influence stress, anxiety, emotion control, and headache of children, and in what age that children can practice PMR is presented as follows:

### 3.2 Duration and Session of PMR

Children who are intervened PMR for 15-20 minutes a day show the decrease of stress score from 133 to 116 in the first month, and the result becomes 117 after 3 months,  $p < 0.05$  (Manjushambika, Prasanna, Vijayaraghavan, & Sushama, 2017). PMR of which the duration is 25 minutes and which is practiced 6 to 12 sessions will effectively decrease anxiety, depression, and stress. In addition, it increases attention and interest (Hashim & Zainol, 2015). PMR exercises (15 minutes a day or 3 days in a week, conducted for 9 successive weeks) show meaningful changes in all of the measurements of research variables:  $p < 0.001$  for anxiety and  $p < 0.005$  for attention focus (Srilekha, Soumendra, & Chattopadhyay, 2013). PMR with 30-minute duration is effectively applied as a stress management (Mason, Burkhart, & Lazebnik, 2018). Practicing PMR once in a week for an hour within 3 months will meaningfully overcome stress (Olmedilla-zafra, Rubio, Ortega, & García-mas, 2017). Group of PMR experiences stress level decrease ( $Z = -2.14$ ,  $p = 0.032$ ) in which PMR is conducted once in a day for 30 minutes within 5 days (Chan et al., 2015).

The effect of PMR is good not only for anxiety and stress, but also for other functions in children. Children who get 12 session of PMR will be able to increase their short memories (Hashim & Zainol, 2015). Exercises conducted once a week for 1 hour in each session will effectively decrease children's illness with value  $p < 0.001$ ,  $r^2 = 0.309$  (Olmedilla-zafra, Rubio, Ortega, & García-mas, 2017). PMR with 20-minute duration will make autism children experience increase of emotion control (Chan, Sze, Siu, Lau, & Cheung, 2013). Practicing PMR once in

a day within 3 months will effectively decrease duration, frequency, and degree of headache (Jong et al., 2018). PMR with 20-minute duration in 3 sessions of each week can increase time to answer questions or assist mentally disabled children to become more perceptive. The PMR intervention group requires 58 seconds while the control group requires 70 seconds to answer a question (Chan, Sze, Siu, Lau, & Cheung, 2013). However, PMR with 11-minute duration does not meaningfully increase children's ability from language retardation (Murray, Scott, Connolly, & Wells, 2018).

### 3.3 Children's Age

The 11 articles indicate that the children are 4-20 years old, in which the youngest is 4 years old (Chan et al., 2015), and the oldest is 20 years old (Mason, Burkhart, & Lazebnik, 2018).

## 4 DISCUSSION

The systematic review shows that there is positive effects of PMR on children. There are several variations of duration which has positive meaning to the PMR training, they are 15 minute-duration of PMR shows significance for children (Manjushambika, Prasanna, Vijayaraghavan, & Sushama, 2017; Srilekha, Soumendra, & Chattopadhyay, 2013), 20 minutes (Chan, Sze, Siu, Lau, & Cheung, 2013), 25 minutes (Hashim & Zainol, 2015), 30 minutes (Chan et al., 2015; Mason, Burkhart, & Lazebnik, 2018), and 60 minutes (Olmedilla-zafra, Rubio, Ortega, & García-mas, 2017), but 11 minute-duration does not show significance for children (Murray, Scott, Connolly, & Wells, 2018). Longer duration of PMR in one session will give more positive impacts to children.

Musthaq & Khan (2018) makes guidance of PMR exercise, that is following the step bellow in times 20 minutes.

- a. To sit on a chair as comfortably as possible. Keep your body loose, continues to light and free.
- b. Be calm and comfortable.
- c. Keep your eye closed.
- d. Avoid stray thoughts.
- e. Avoid extra movements of the body.
- f. During the part of the exercise cycle tense the muscle tightly and hold for slow count of 5 seconds. (Repeat silently 1001, 1002, 1003,...)

- g. During the relation part of exercise cycle relaxes the muscle quickly and completely .let your mind relax and appreciate how relaxed the muscle is feeling for 10 seconds.
- h. Try to keep all other muscles relaxed as you exercise specific muscle group.
- i. As you exercise from head to toe. Observe changes like tightness and the development of light and soothing sensations.

Table 1: Description of The Selected Studies.

(Authors, Year) & Country	Result
(Jong et al., 2018) Netherlands	<p><b>Method:</b> RCT. Intervention group used mind-body techniques (transcendental meditation or hypnotherapy vs Control group used progressive muscle relaxation, instrument used RCADS, CSI and PCQ.</p> <p><b>Age of Sample:</b> 131 children with 9 -18 years old.</p> <p><b>Main Result:</b> Headache frequency, the primary outcome, was significantly reduced in all groups (from 18.9 days to 12.5 and 10.5 at respectively 3 and 9 months; <math>p &lt; 0.001</math>), pain medication was significantly reduced in all children at 3 months (<math>p = 0.003</math>) and 9 months (<math>p = 0.032</math>), but no significant differences were observed between the three groups.</p> <p><b>Author Conclusion:</b> non-pharmacological techniques effectively reduce the number of primary headache in children</p>
(Mason, Burkhart, & Lazebnik, 2018) USA	<p><b>Method:</b> Cohort. Intervention group participants received training in diaphragmatic breathing, progressive muscle relaxation (30 minutes), and use of no-cost/low-cost exercise options.</p> <p><b>Age of Sample:</b> 86 adolescents with 11-20 years old.</p> <p><b>Main Result:</b> There was not a significant difference between the intervention group and the control group on key study variables (generalized anxiety, depression, perceived stress, pre-intervention subjective units of distress score, and pre-intervention coherence rates), SUDS scores was a significant (<math>p &lt; 0.001</math>), and HRV was a significant (<math>p = 0.003</math>).</p> <p><b>Author Conclusion:</b> Integrated care model in a primary care setting is feasible and effective at improving stress management.</p>
(Chan et al., 2015) Hong Kong	<p><b>Method:</b> Exploratory trial using a pre-teste post-test control group design. PMR given to intervention group for 30 minutes.</p> <p><b>Age of Sample:</b> 65 patients who diagnosis of cancer and still chemotherapy, aged 4-11 years. <b>Main Result:</b> Group PMR had significantly lower levels of child anxiety (<math>Z = -2.14</math>, <math>p = 0.032</math>) than education group, No statistical differences in body weight, the occurrence of nausea and vomiting, the intake of antiemetics, and anxiety level (<math>p &gt; 0.05</math>) between the two intervention groups.</p> <p><b>Author Conclusion:</b> The intervention process and higher levels of perceived usefulness of intervention were given by patients in the relaxation group compared to those in the education group.</p>
(Manjushambika, Prasanna, Vijayaraghavan, & Sushama, 2017) India	<p><b>Method:</b> RCT. Jacobson's Progressive Muscle relaxation (JPMR) took about 15-20 minutes daily.</p> <p><b>Age of Sample:</b> 145 students, range of ages 11-17 year.</p> <p><b>Main Result:</b> JPMR was statistically significant (Mc Nemer Chi-square =16.06; <math>p &lt; 0.001</math>). We conclude that JPMR was effective in reducing the stress significantly.</p> <p><b>Author Conclusion:</b> JPMR is effective in reducing educational stress among adolescents.</p>
(Hashim & Zainol, 2015) Malaysia	<p><b>Method:</b> Quasi experiment used 25 min pre-recorded PMR compact disc (CD), DST for measured short-term memory, DVT for measured attention, and DASS21 to measure depression, anxiety, and stress levels.</p> <p><b>Age of Sample:</b> 132 primary school students, 24% 10 years old, and 76% 11 years old.</p> <p><b>Main Result:</b> A significant difference among the groups in mean changes in short-term memory (<math>F = 3.89</math>, <math>df = 2</math>, and <math>p &lt; 0.05</math>), 12 session PMR &gt; 6 session PMR or no Intervention group, and no significant differences were observed among the groups in anxiety (<math>p &gt; 0.05</math>), depression (<math>p &gt; 0.05</math>), stress (<math>p &gt; 0.05</math>), or sustained attention (<math>p &gt; 0.05</math>)</p> <p><b>Author Conclusion:</b> This particular finding may provide general support for the use of at least 12 sessions of PMR training, to reduce stress level, increase attention and strength short-term memory.</p>
(Chan, Sze, Siu, Lau, & Cheung, 2013) Hong Kong	<p><b>Method:</b> RCT. Intervention group used Chinese mind-body intervention (Nei Yang Gong) Control group used PMR (20 minutes)</p> <p><b>Age of Sample:</b> 48 students (autism child), range of ages 6-17 year.</p> <p><b>Main Result:</b> The results showed that there were significant and marginally significant Time (Pre vs Post) by Group (Control vs Experimental) interaction effects on the two indices of the TOLDX, i.e., the frequency of rule violation, <math>F(1,34) = 6.02</math>, <math>p = 0.02</math>, and the initial time, <math>F(1,34) = 3.25</math>, <math>p = 0.08</math>.</p> <p><b>Author Conclusion:</b> Nei Yang Gong and PMR had a positive effect in enhancing the self-control of children with autism spectrum disorders, but elevated brain activity was not observed in the children practicing PMR.</p>

Table 1: Description of The Selected Studies (cont.).

(Authors, Year) & Country	Result
(Olmedilla-zafra, Rubio, Ortega, & Garcia-mas, 2017) Spain	<p><b>Method:</b> RCT. Included the following modules:                      1. Linking thoughts and emotions;                      2. PMR breathing, imagery, passive and differential muscle relaxation;                      3. Self- instructional and attention-focus training; and                      4. Stress inoculation training.</p> <p><b>Age of Sample:</b> 74 male soccer players from, range of ages 17-19 year.</p> <p><b>Main Result:</b> There were no significant differences between the two groups regarding the average number of injuries before the treatment, <math>t(61)=-0.460</math>, <math>p=0.647</math>. The differences between the groups were significant in the post-treatment phase (<math>p=0.005</math>, <math>r^2=0.077</math>), showing that the average number of injuries was larger in the non-treatment group.</p> <p><b>Author Conclusion:</b> A program aimed at controlling the stress response can reduce the incidence of sports injuries in young athletes.</p>
(Murray, Scott, Connolly, & Wells, 2018) England	<p><b>Method:</b> RCT. Intervention used Attention Training Technique (ATT) and PMR (min. 11 minutes).</p> <p><b>Age of Sample:</b> 101 children (learning or behavioural difficulty) with 5.55 -6.82 years old.</p> <p><b>Main Result:</b> (Time: Pre vs Post) x 3 (Condition: ATT vs PMR vs no-intervention) revealed a significant effect of time, <math>F(1, 98)=32.79</math>, <math>p &lt; .0005</math> and no significant effect of condition, <math>F(2, 98)=1.23</math>, <math>p=0.30</math>.</p> <p><b>Author Conclusion:</b> ATT showed an improvement in delay of gratification that was significantly greater than shown in the PMR or no-intervention group.</p>
(Srilekha, Soumendra, & Chattopadhyay, 2013) India & Bangladesh	<p><b>Method:</b> Quasy experiment with pre post test. PMR given to intervention group for 15 minutes per day, 3 days per week for 9 consecutive weeks.</p> <p><b>Age of Sample:</b> 80 boys, age range of 9-12 year.</p> <p><b>Main Result:</b> PMR training showed significant changes on all of the variables measures in the desired direction (<math>p&lt;0.001</math>) for anxiety and (<math>p&lt;0.005</math>) for attention.</p> <p><b>Author Conclusion:</b> Abbreviated version of PMR exercise training could be effective enough in modulating heightened emotionality, reduction of dispositional anxiety and improvement in attentive performances.</p>
(McKenney, Broach & Mullen, 2018) USA	<p><b>Method:</b> Quasy experiment. Intervention used Multisensory training (MST) vs PMR 20 minutes.</p> <p><b>Age of Sample:</b> 8 students (behavior disorder), range of ages 7-14 year.</p> <p><b>Main Result:</b> Overall mean time on task score for all participants after MST was 72 seconds, compared to 58 seconds after the PRT sessions, and 70 seconds after the control sessions.</p> <p><b>Author Conclusion:</b> The mean time on task score for MST was slightly higher when compared to scores obtained from the PRT and control sessions.</p>

- j. Relax by taking three deep breaths inhaling through nose and exhaling through mouth after each step.
- k. Now make your body completely loose, continuous feeling light and free

Children at least 4 years old possibly practice PMR. The category of childhood is under 19 years old or younger. This statement is in line with national law in each country. In the age of 10-19 years old, people will be categorized as adolescent (WHO, 2013). Four-year-old children eagerly have their first valley of development process, because they can see the world in a bigger perspective. Children start to ask about the world and are interested in many things, and thus, they feel anxious and even stressed for facing unfamiliar world (Department of Health Western Australia, 2018). It can be a stressor for children because of unsupportive environment.

## 5 CONCLUSIONS

The systematic review reveals that PMR possibly assists children to maximize positive influence of relaxation to control stress and anxiety. PMR is considered meaningful if it is practiced in at least once a day for 15 minutes in each session of training. Based on the result of analysis, PMR can be practiced since the children are 4 years old. Recommendation for researcher, effect PMR in Children should be developed by researcher in Indonesia.

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