

## BRAIN GYM EFFECTIVELY REDUCES ANXIETY IN SCHOOL-AND PRESCHOOL-AGED CHILDREN IN HOSPITALS

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### Abstract

Hospitalization-induced anxiety in children can impede healing and lengthen hospitalization. As such, appropriate interventions are needed to reduce their anxiety during hospitalization. For example, brain exercise has been shown to reduce anxiety in children in diverse settings and developmental stages. This study was performed to compare the effect of brain exercise on anxiety in hospitalized school- and preschool-aged children. A pre-experimental pre/posttest design was used, and 32 children were selected by consecutive sampling. Brain gym was given twice a day for 2 consecutive days. Data were collected from school-aged children by using a modified Zung Sel-Rating Anxiety Scale and Tailor Manifest Anxiety Scale and from preschoolers by utilizing a modified Hamilton Anxiety Rating Scale observation sheet. Wilcoxon test results showed that brain gyms were effective in reducing anxiety in school-aged children ( $p = 0.016$ ) and preschoolers ( $p = 0.006$ ). Movements during brain exercises could activate the neocortex and parasympathetic nerves that can ease psychic and physical tension. Therefore, brain gym can be an effective intervention to decrease anxiety in preschoolers and school-aged children.

**Keywords:** anxiety, brain gym, preschoolers, school-age

### Abstrak

*Brain Gym Efektif Menurunkan Kecemasan Pada Anak Usia Sekolah dan Pra Sekolah di Rumah Sakit. Kecemasan akibat rawat inap pada anak dapat menghambat penyembuhan dan memperpanjang rawat inap. Dengan demikian, intervensi yang tepat diperlukan untuk mengurangi kecemasan mereka selama dirawat di rumah sakit. Misalnya, latihan otak telah terbukti mengurangi kecemasan pada anak-anak dalam berbagai pengaturan dan tahap perkembangan. Penelitian bertujuan untuk membandingkan pengaruh senam otak terhadap kecemasan pada anak usia sekolah dan pra-sekolah yang dirawat di rumah sakit. Penelitian menggunakan desain pre-eksperimen pre/posttest, dan 32 anak dipilih dengan sampel konsekutif. Senam otak diberikan dua kali sehari selama dua hari berturut-turut. Data yang dikumpulkan dari anak-anak usia sekolah menggunakan modifikasi Zung Sel-Rating Anxiety Scale dan Tailor Manifest Anxiety Scale, sedangkan data anak-anak prasekolah menggunakan lembar observasi modifikasi Hamilton Anxiety Rating Scale. Hasil uji Wilcoxon menunjukkan bahwa senam otak efektif menurunkan kecemasan pada anak usia sekolah ( $p = 0,016$ ) dan anak prasekolah ( $p = 0,006$ ). Gerakan pada saat senam otak dapat mengaktifkan neokorteks dan saraf parasimpatis yang dapat meredakan ketegangan psikis dan fisik. Oleh karena itu, senam otak dapat menjadi intervensi yang efektif untuk menurunkan kecemasan pada anak prasekolah dan usia sekolah.*

**Kata Kunci:** kecemasan, prasekolah, senam otak, usia sekolah

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### Introduction

Anxiety is a problem generally experienced by hospitalized children. About 25–38% of children experience long- and short-term hospitalization, and 7–40% of these children have unpleasant experiences and symptoms of anxiety

(Meentken et al., 2021; Sen, 2020). In Indonesia, several studies have demonstrated that 50–80% of hospitalized children show an anxiety reaction (Juwita, 2019; Wilujeng, 2018).

Anxiety reaction caused by hospitalization is mostly due to separation from parents/relatives

/friends, loss of self-control, and fear of the pain they face. It has various manifestations due to hospitalization. Generally, children are fussy, restless, and whiny; they cry, scream, kick, and say rude things; they do not want to be separated from their parents and even refuse the presence of health workers (Chodidjah & Syahreni, 2015; Vianti, 2020).

Another problem is that children can also show regression behavior, dependence on parents, temper tantrums, and negativism. Several studies have demonstrated that hospitalization can cause posttraumatic stress symptom (PTSS) reactions that can continue even though children are no longer hospitalized after several years (Chodidjah & Syahreni, 2015; Meentken et al., 2021; Wilujeng, 2018).

Hospitalization reactions experienced by children can cause various negative impacts. For example, hospitalized children for more than 2 weeks have a risk of language disorders and poor cognitive skill development. In addition, these affect the treatment process and prolong the hospitalization stay because children refuse care and treatment (Claridge et al., 2020; Wilujeng, 2018).

Hospitalization provides an unpleasant experience to children because they are separated from their family, they are in an unfamiliar environment, and they experience pain sensations (Chodidjah & Syahreni, 2015). Hospitalization experience influences subsequent hospitalization reactions, and children who have had one or more hospitalization experiences show higher levels of anxiety and depression (Meentken et al., 2021).

Hospitalization in children can cause vulnerable conditions toward their development aspects, such as physical development, intelligence, and emotion. Therefore, children need interventions to help them adapt to hospitalization. Nursing interventions that can improve the adaptability of children during hospitalization are play therapy, information dissemination, relaxation tech-

niques, distraction, music therapy, group therapy, and strategies to increase expectations (Barros et al., 2021). An example of play therapy is brain gym, which involves many muscles that can utilize the full potential of the brain through movement and touch (Adimayanti et al., 2019; Wilujeng, 2018).

Several studies on brain gym have been carried out in preschool- and school-aged children. For instance, a previous study compared the effectiveness of the brain gym in child-parent relationship therapy and found that the brain gym is effective in reducing mental-emotional problems in school-aged children (Moradi et al., 2020).

Another study on the effectiveness of brain gym in preschoolers demonstrated a decrease in anxiety score and cortisol level in hospitalized preschool children (Wilujeng, 2018). In addition, Dikir et al. (2016) observed that brain gym significantly affects the stress level of school-aged children. Therefore, brain gym is effective in school- and preschool-aged children. However, the effectiveness of brain gym on anxiety due to hospitalization has yet to be explored in these two groups.

## **Methods**

A pre-experimental research design was used in this study. A total of 32 children consisting of 14 school-aged children and 18 preschool-aged children were sampled via consecutive sampling. The sample size was determined on the basis of the number of school- and preschool-aged children who were treated in the children's room during the time span of the study (1 month) and met the established criteria. The studied variables were anxiety in children before and after the brain gym intervention was given. Data were collected using a modified questionnaire of the Zung Self-Rating Anxiety Scale and Tailor Manifest Anxiety Scale in school-aged children and a modified Hamilton Anxiety Rating Scale observation sheet to assess anxiety in preschool-aged children. Cronbach's alpha reliability was 0.94.

Children were chosen as respondents if they satisfied the following inclusion criteria: aged 3–12 years, children who were treated in an in-patient pediatric room, children and parents who expressed their willingness to be involved in the study, and children who completed the entire series of interventions. They were excluded if they met the following exclusion criteria: preschool- and school-aged patients with impaired physical mobility such as fractures, paresis, and cerebral palsy because these limitations would cause bias to the intervention procedure. The included patients were grouped on the basis of age. Children aged 3–6 years were included in the preschool-aged group, and those aged 7–12 were placed in the school-aged group.

This study was conducted in two public hospitals in Makassar City. First, the anxiety scores of the hospitalized children were measured. Afterward, the children were included in the category of experiencing anxiety. The children and their parents were asked if they would participate in the study. If the children and their parents were willing to be respondents, a consent

form was obtained. Each research subject was subjected to brain gym activities for 30 min twice a day for 2 consecutive days.

The brain gym intervention consisted of two stages: the preparation stage and the implementation stage. The preparation stage was composed of four components, namely, Positive, Active, Clear, and Energetic (PACE). The sequence of the preparation stage was described as follows: 1) the movement of the energetic component, namely, the activity of drinking water; 2) the movement of the clear component, namely, the activity of massaging the brain switch area (brain buttons); 3) the movement of the active component, namely, the activity of doing cross movements (cross crawl); and 4) the movement of the positive component, namely, the activity of relaxing oneself. The PACE movement was followed by other brain gym movements, such as the movement of pressing the earth button, the balance button, the space button, the thinking cap, and the energetic yawn (Dennison & Dennison, 2002). The illustration of the stages of the brain gym movement are given can be seen in Figure 1.

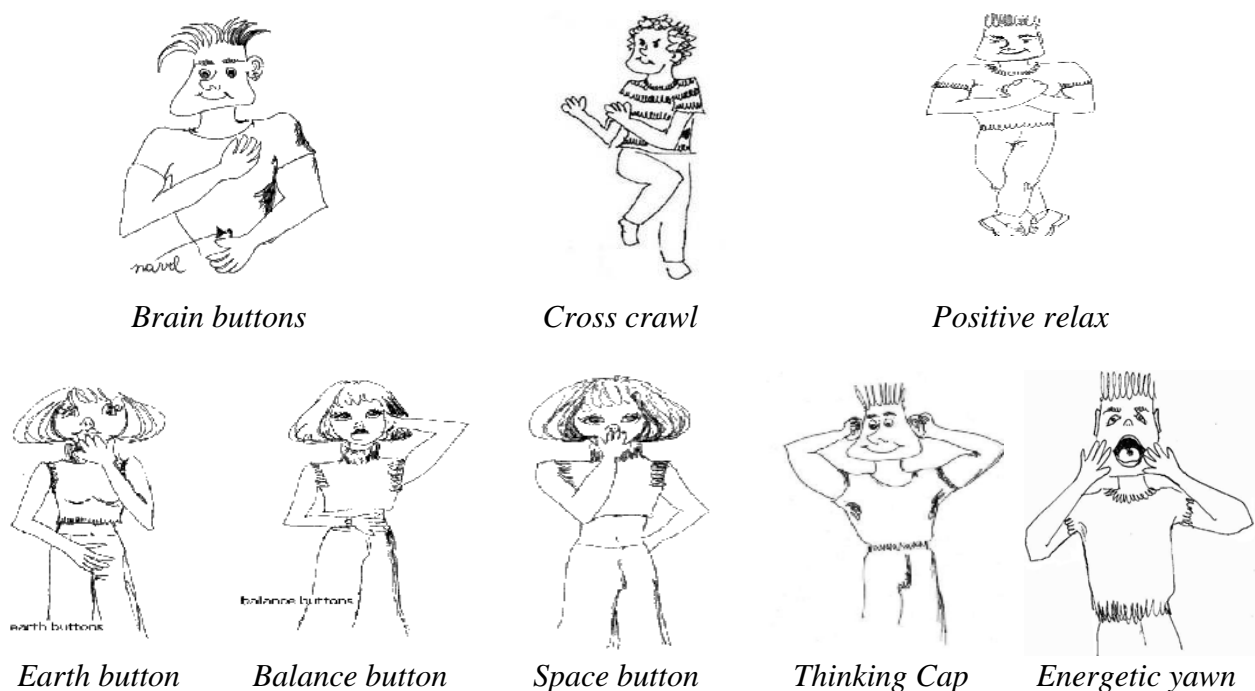


Figure 1. The Stages of the Brain Gym Movement (Widianti, 2011)

The intervention was given by two research members who were trained in brain gym and able to provide brain gym intervention according to the established procedure: one researcher for the school-aged group and the other for the preschool-aged group. The children who completed the intervention procedure were then evaluated for posttest measurement the next day by using the same instrument used in the pretest. The pretest and posttest measurements were carried out by the intervention provider. Data were then examined using Wilcoxon signed rank statistical analysis via a computer program.

## Results

**Respondent Characteristics.** Respondents in the school-aged group were 14 patients dominated by children aged over 10 years. Those in the preschool-aged group were 18 patients dominated by children aged 6 years. The school-aged group was dominated by male respondents, and the preschool-aged group was dominated by female respondents (Table 1).

**Effectiveness of Brain Gym on Anxiety in School-Aged Children.** Wilcoxon rank statistical test yielded  $p = 0.016$ , indicating that brain gym was effective in reducing anxiety in school-aged children. The level of mild anxiety in school-aged children was observed in 2 children at the time of the pretest, and the level of moderate anxiety was detected in 12 children (Table 2). In the posttest, the levels of mild and moderate anxiety were found in 7 children each. Table 2 explains the differences in anxiety levels in school-aged children before and after being given the brain gym intervention.

**Effectiveness of Brain Exercise on Anxiety in Preschool-Aged Children.** In preschoolers, Wilcoxon rank test results yielded  $p$  value = 0.006, indicating that brain gym was effective in reducing anxiety in preschool-aged children. In particular, the number of children experiencing severe and moderate anxiety decreased after they were given an intervention (posttest), whereas the number of children with mild anxiety levels increased. Before the intervention, four

Table 1. Respondent Characteristics

Children characteristics	Preschool age		School age	
	n	%	n	%
Age				
5 years	5	27.8	-	-
6 years	13	72.2	-	-
7–9 years	-	-	5	35.7
10–12	-	-	9	64.3
Sex				
Male	5	27.8	10	71.4
Female	13	72.2	4	28.6

Table 2. Anxiety Levels Before and After Brain Gym at School Age

School-aged group	Anxiety level				p
	Mild		Moderate		
	n	%	N	%	
Pretest	2	14.2	12	85.7	0.016*
Posttest	7	50	7	50	

\*Wilcoxon Rank Test

Table 3. Anxiety Levels Before and After Brain Gym at Preschool Age

Preschool-aged group	Anxiety Levels						p
	Mild		Moderate		Severe		
	n	%	n	%	n	%	
Pretest	8	44.5	4	22.2	6	33.3	0.006*
Posttest	17	94.4	0	0	1	5.56	

\*Wilcoxon Rank Test

children had moderate levels of anxiety. After the intervention, no children suffered from moderate anxiety, and the number of children with severe anxiety decreased to 1. Table 3 explains the differences in anxiety levels in preschool-aged children before and after they were given the brain exercise intervention.

## Discussion

Hospitalization is an uncomfortable situation that causes a decline in health condition because it is not in a family's social environment. If children are hospitalized, their family routines change, their development is altered, and they may experience anxiety (Gomes et al., 2016). Physical injuries and illnesses in children are events that have the potential to cause trauma to children and adolescents, and many children experience psychosocial difficulties after hospitalization. PTSS, depression, and anxiety are the most common symptoms experienced by hospitalized children. Therefore, pediatric nurses need to know the signs of stress in children and parents and should have the ability to overcome the impact of hospitalization on children (Meentken et al., 2021).

Anxiety consists of emotional conditions with psychological, social, and physiological components that can affect individuals at every stage of development. This condition is considered pathological when it is excessive or disproportionate in relation to the stimulus or qualitatively different from what would be expected in a given age group. Therefore, anxiety must be identified and treated as early as possible, especially when it is experienced by children un-

dergoing hospitalization (Gomes et al., 2016).

**Effectiveness of Brain Gym in School-Aged Children.** Brain gym effectively reduced anxiety in school-aged children undergoing hospitalization. Their level of anxiety decreased from severe to mild and from moderate to mild. These findings were consistent with a study conducted on first-grade elementary school children who were given brain gym; their social anxiety scores decrease after the intervention (Prabowo & Khusnal, 2015). Another study on fifth-grade elementary school children has shown that stress levels in children decrease after they receive the brain gym (Dikir et al., 2016).

School-aged children undergoing hospitalization perceive that hospitalization is a punishment. They feel insecure, are separated from their daily environment, and have limitations in carrying out their activities independently. Children's mood decreases because of health and environmental conditions that differ from their usual daily habits. They also have limitations in responding to and solving problems properly. Children's reactions to hospitalization are influenced by factors such as age, experience of illness, separation, experience of being hospitalized, nature of the children, coping skills, emergency diagnosis, and support systems (Hockenberry et al., 2011).

Chodidjah and Syahreni (2015) conducted a qualitative study and observed that school-aged children experiencing hospitalization have several sources of stress and anxiety. For example, carrying out their routines is limited, they have an uncomfortable treatment room atmosphere,

they are not free to determine what they want, and they feel pain during treatment. Nevertheless, hospitalization also teaches children to develop their ability to cope with stressors. One of the efforts they make is playing games. This observation is consistent with this study, which provided brain gym in the form of active movements, such as playing, so that it could provide pleasure and help reduce stressors and anxiety in school-aged children.

Brain gym movements train the coordination and brain function requiring children's concentration to focus on thoughts and follow instructions through movements to balance the brain. The brain is stimulated by simple movements of the hands and feet. The stimulus from this movement affects the increase in the concentration, attention, alertness, and ability of the brain to plan, respond, and make decisions (Sulistiadi et al., 2020).

Brain gym provides simple, fun movements that can improve children's ability to reduce anxiety, stress, and depression, which are packaged by playing media so that they can appreciate all forms of movement by using the whole brain. Moreover, it provides relaxation to children and physical and psychological comfort, which are also expected to offer environmental and social comfort (Wilujeng, 2018).

The working principle of the brain gym is to activate the three dimensions of the brain, namely, concentration dimension, lateral dimension, and focus dimension. The concentration dimension can increase blood flow to the brain, thereby increasing the reception of oxygen, which can cleanse the brain, including clearing negative thoughts. The lateral dimension stimulates the coordination between the right and left parts of the brain so that it can reduce fatigue and improve breathing, stamina, and relaxation. The focus dimension helps release the inhibition of focus from the brain, thereby enhancing attention and concentration power (Sulistiadi et al., 2020).

Brain gym involves kinesthetic exercises, breath-

ing, and massage on the body's energy centers. It aims to increase the oxidation of blood flow to the brain and the speed of nerve impulses between the hemispheres so that they can work together efficiently and increase mental capacity. This technique is helpful for those who have difficulty in focusing and adapting to new situations and experience stress and anxiety (Fadli & Kheddouci, 2018).

Anxiety causes an increase in the work of the sympathetic nervous system, which increases the production of the hormone adrenaline, resulting in an increase in tension in the membranes of nerve cells. The movements in brain gym increase energy and activate the neocortex so that it can refocus electrical energy to the nerve center for positive thinking. This mechanism further activates the parasympathetic system and reduces the release of adrenaline. Brain gym activities make the parts of the brain work well together to improve children's memory, optimize fine motor skills, increase concentration, and keep the body relaxed (Dikir et al., 2016).

**Effectiveness of Brain Gym on Preschool-Aged Children.** The anxiety level of the hospitalized preschool-aged children significantly decreased after they had the brain gym. These results were consistent with previous findings on brain gym conducted on hospitalized preschool-aged children. For example, Adimayanti et al. (2019) demonstrated that anxiety scores in the intervention group significantly decrease compared with those in the control group. They also found a decrease in the average cortisol level, where the mean cortisol value before the brain gym intervention is 570.20, which decreases to 67.81 after the brain exercise intervention. In addition to the mean cortisol, anxiety scores of preschoolers decrease (Wilujeng, 2018).

Gomes et al. (2016) found that some aspects can suppress and threaten children when they are in a hospital environment. Children feel deprived of family and social interactions; consequently, they have to interact with a strange en-

vironment. Moreover, they have to undergo invasive procedures and experience pain. They have to stop their recreational activities partially. Therefore, preschool-aged children undergoing hospitalization are susceptible to stress and anxiety.

Anxiety in preschool-aged children must be addressed immediately because it can prevent children from undergoing treatment, thereby worsening their condition. One of the effective interventions to deal with stress in children is playing. Activities that use multiple muscles can help children release tension (Hockenberry et al., 2011).

They can be performed by providing a safe and structured environment that helps develop and maintain daily routines and thus reduces clinical anxiety in children. Daily routines that can be carried out are eating nutritious foods, getting enough sleep, watching television, playing games with limited time, and doing physical activities that manage feelings of depression and anxiety in children (Beyondblue, 2014).

Preschool age is an appropriate age to be given the brain gym. In this period of development, children can follow the commands of simple movements (Wilujeng, 2018). Brain gym is a play activity involving a collection of simple movements that require many muscles. It aims to connect and coordinate the body and the mind. Furthermore, it can improve children's abilities and reduce anxiety due to hospitalization with a play approach. It can also provide relaxation, which is physical and psychological comfort to children (Dennison & Dennison, 2002; Fadli & Kheddouci, 2018).

Brain gym is an intervention that can be performed to overcome anxiety disorders by initiating the movement of drinking water, cross movement, earth button, space button, balance button, relax hook, and energetic yawn (Fadli & Kheddouci, 2018). Movements in brain gym can stimulate the neocortex and parasympathetic nerves to inhibit the release of adrenaline

that can reduce psychological and physical tension in children (Dennison & Dennison, 2002). The movements in brain gym are claimed to produce endorphins, which are endogenous morphine functioning as a natural sedative produced by the body, causing a comfortable effect, reducing anxiety, and eliciting calming sensations (Prabowo & Khusnal, 2015).

This study has limitations. Several factors that could cause a research bias were not controlled because of the limited number of respondents when this study was conducted. These factors included differences in the type of disease experienced by the patients and the patient's sociodemographic condition. Thus, further research should be performed to better control these factors.

This study has implications for the field of nursing services, where brain gym can be one of the nursing interventions to reduce anxiety in hospitalized school- and preschool-aged children. In addition, the results of this study can be used as a reference for enhancing the understanding of the working mechanism of brain gym as an intervention in providing nursing care to children who experience anxiety.

## Conclusion

This study shows that brain gym given for 30 minutes twice a day for 2 consecutive days is effective in reducing anxiety due to hospitalization in school- and preschool-aged children. Brain gym movements can activate the neocortex and parasympathetic nerves, thereby relieving psychological and physical tension. Therefore, this brain gym treatment can be an effective intervention in reducing anxiety in hospitalized school- and preschool-aged children.

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