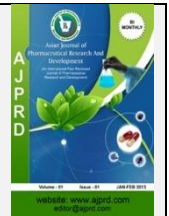


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Research Article

Effect of cognitive stimulation based on puzzle games on learning achievement in school-aged stunted children

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ABSTRACT

Introduction; Stunting causes obstacles to physical development but also threatens cognitive development which has an impact on reducing children's productivity in adulthood. So efforts are needed to help cognitive development of stunting children through educational games.

Objective; Effect of Puzzle Game-Based Cognitive Stimulation on Learning Achievement of Stunted Children of School Age.

Method; This type of pre-experimental research with a one group pre test-post test design. This study used measurements three times before the intervention and three times after the intervention. A sample of 36 people with the criteria of a stunted child based on BMI results according to measurements of height/age and weight/age.

Results; the average value of stunting children's learning achievement given cognitive stimulation based on a puzzle game is PreTest 1 = 70.36, Post Test 1 = 69.36; Pre Test 2 = 72.36, Post Test 2 = 69.36, and PreTest 3 = 74.63, Post Test 3 = 70.72. In the statistical test results with the paired T-Test, there is a statistically significant difference ($p < 0.05$) significant for all puzzle game interventions given to stunting children.

Suggestion; the need for cognitive stimulus-based learning methods through puzzle games, as a learning approach technique for elementary school-age children who are stunted.

Keywords: Stunting, education, Puzzles; cognitive, performance

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INTRODUCTION

Globally, the global prevalence of stunting in 2017 was 22.2% or around 150.8 million children under five in the world were stunted. According to data from the World Health Organization (WHO), Indonesia is included in the third country with the highest prevalence in the Southeast Asia region. The average prevalence of stunting in Indonesia in 2005-2017 was 36.4%.

Currently, stunting has become a national problem, so massive efforts have been made to prevent stunting. The incidence of stunting in the Southeast Sulawesi Province region in data from the Southeast Sulawesi provincial health office for 2019 shows stunting of children under five aged 0-59 months = 2920 children. According to Riskesdas data, Southeast Sulawesi Province,

stunting cases in 2013 amounted to 31.4%, in 2017 it increased to 36.4%.

Stunting causes obstacles to physical development but also threatens cognitive development which has an impact on reducing children's productivity in adulthood. Delay in cognitive development in children is also associated with the incidence of stunting which can result in abnormal developmental delays. Stunting is a chronic condition that describes stunted growth in children due to long-term malnutrition.¹

Stunting in early childhood is significantly negatively related to children's cognitive performance, which is related to variables such as: duration of breastfeeding, normal size of child at birth, early childhood health problems such as acute respiratory disease and malaria, household economic conditions, child's gender, health and

environmental conditions of the household and parents' education, one of the results of the study showed that children who were stunted on the Quantitative Assessment test at the age of eight scored 16.1% less in the Peabody Picture Vocabulary Test and 48.8% less, both were statistically significant at $p < 0.01$.²

Child development is certainly a priority aspect that continues to be considered by parents and health practitioners in the field of child development. One important part of child development is cognitive development. Cognitive is the process of thinking in an individual's ability to relate, assess, and consider an event, referring to mental activity in acquiring, and using knowledge. Cognitive abilities are the result of the relationship between the development of the brain and the nervous system and experiences that help individuals adapt to their environment.³

There is a need for basic treatment efforts for children who are stunted so that they have cognitive development according to the stages of their development so as to obtain optimal learning achievement. One effort that can be done is to intervene in the form of cognitive stimulation to children. Stimulation can come from various things in the environment around children, starting from interactions with parents, interactions with objects, motor games, household activities, books, social activities and play tools that can stimulate children's development. However, in making school-age children's activities effective, game activities play an important role for children, because this is in accordance with the character of children at a developmental age who have a penchant for playing.⁴

One of the educational games that can encourage children's cognitive activity is a puzzle game with modifications in such a way as to accommodate elements of subject matter that are appropriate to the child's educational level. Puzzle is a game that arranges an image into a complete shape from pieces. By playing puzzles children can train intelligence in solving problems. Puzzle games also involve eye and hand coordination and children can explore according to their abilities and interests.⁵

METHODS AND MATERIALS

This type of research is pre-experimental using a one group pre test-post test design. This study used three measurements, namely

before and after the intervention. The measurement taken before the intervention (X_1) is called the pretest, and the measurement taken after the puzzle game intervention (X_2) is called the posttest. In an effort to eliminate bias from the research results, pre-tests and post-tests were carried out at each stage of giving the puzzle game. The population in this study were all school-aged children at Public Elementary School 101 totaling 147 people. The number of samples is 36 people, and the sampling technique used is Proportional stratified random sampling with sample criteria namely: Stunted children based on BMI results according to measurements of height/age and weight/age, registered as students at SDN 101 Kendari City for the 2022/2023 academic year, willing to be a respondent by participating in the research to completion, able to read and write, stunting category based on measurement results.

Data collection was carried out by measuring height/age and weight/age to find out BMI as a category of children with stunting. The child's height was measured using a microtoise, while the weight was measured using a bare foot weight scale. Anthropometric measurements (BMI/A) based on the Anthropometric Standards of the Ministry of Health (2013), the stunting category if the results of BMI/A measurement are < -3 SD to < -2 SD.

Respondents were given a game-based cognitive stimulation media intervention in the form of a puzzle game as a cognitive stimulation medium which contains ways, information and game techniques that can stimulate the accelerated development of stunted children's cognitive abilities. Giving games is carried out 1 time (morning) everyday for 24 consecutive days with a total of 24 times giving. Measurement of learning achievement was carried out by comparing learning outcomes before (PreTest) and after (PostTest) the puzzle game intervention to evaluate children's learning achievement after the intervention was completed.

The statistical test used in the bivariate analysis is the comparative analysis test (test of difference). The variable that will be assessed using the two-mean different test is the variable level of learning achievement before and after the Puzzle Game Media Giving Intervention, Using the Paired T-Test.

RESULTS

Table 1: Gender Response Characteristics

Gender	Frequency	Persentase %
Male	19	52,78
Perempuan	17	47,22
Total	36	100

In table 1 it is known that the most were male, totaling 19 people (52.78%), and women totaling 17 people (47.22%)

Table 2: Characteristics of Respondents' Age Groups

Age Groups	Frequency	Persentase (%)
7	8	22,22
8	10	27,78
9	6	16,66
10	10	27,78
11	2	5,56
Total	36	100

In table 2 it can be seen that the most in the age group of 8 and 10 years are 10 people each (27.78%), and the 11 year age group is 2 people (5.56%).

Table 3: Data normalitytest

Variabel	Shapiro-Wilk		
	Statistic	df	Sig.
Pre_Test_1	.981	36	0.785
Pre_Test_2	.970	36	0.415
Pre_Test_3	.918	36	0.011
Post_Test_1	.970	36	0.415
Post_Test_2	.946	36	0.078
Post_Test_3	.954	36	0.143
Pre_Test_Total	.972	36	0.469
Post_Test_Total	.966	360	0.316

Table 3 shows the data normality test normally distributed

Table 4: Results of statistical tests of paired T-Test, Pre-Test and Post-Test Cognitive Stimulation Based on Puzzle Games on learning achievement of stunting children

Variabel	Pre Test - M±SD	Post Test M±SD	Value – P Sig. (2-Tailed)
Stage 1 puzzlegame	70.36 ± 5.49	69.361 ± 5.28	0.001
Stage2puzzlegame	69.36±5.28	69.36±3.66	0.000
Stage3puzzlegame	72.36 ±4.67	78.55 ±2.91	0.000
Average	70.72 ±5.05	74.22 ±3.64	0.000

Based on table 6, the results of the paired T=Test statistical test, the learning achievements of stunted children who are given cognitive stimulation based on puzzle games are all significant. Significant with a value ($p < 0.05$), indicating there is a change in the achievement value of stunting children after being given puzzle game-based Cognitive Stimulation therapy

DISCUSSION

Stunting is caused by a complex interaction between household life, environment, socio-economic and culture. Linear growth in early childhood is considered a marker of healthy growth given its association with risks of short-term morbidity and mortality, later non-communicable diseases, and learning capacity and productivity. It is also related to child development in several domains including cognitive, language and sensori-motor abilities. Adequate supply of nutrition, prevention of infection, opportunities for social interaction, play and stimulation are factors that contribute positively to achieving a child's full potential to grow and develop.⁶(R. E. Black et al., 2008; Stewart, Iannotti, Dewey, Michaelsen, & Onyango, 2013).

Stunting is identified by assessing the length or height of the child. International agreement that children are stunted if their length/height is below -2 SD of the WHO Child Growth Standards median for the same age and sex. Similarly, children are considered very short if their length/height is below -3 SD of the WHO Child Growth Standards median for the same age and sex.⁷(de Onis et al., 2013; Organization, 2010). Stunting is a syndrome of linear, short and stunted growth failure which is a marker of various pathological disorders associated with increased morbidity and mortality, loss of physical growth potential, decreased neurodevelopmental and cognitive function, and increased risk of chronic disease in adulthood.⁸

Linear growth before 12 months of age is associated with improved cognitive function at age 8 and linear growth between ages 8 and 15 years is associated with improved cognitive function among adolescents. The improvements between physical growth and cognition are closely linked and can occur throughout childhood and adolescence.⁹(Crookston et al., 2013; Heaton, Georgiadis, McClellan, Forste, & Crookston, 2014). Child development is defined as the orderly development of skills (gross and fine motor, cognitive and language, and personal/social) that are shaped by the interaction of genetic potential and environmental opportunities. Early developmental skills form the basis for later development, including school readiness and performance. As children approach school age, individual and cultural differences emerge. Early risks, including poverty, nutritional deficiencies (stunting and micronutrient deficiencies), and lack of learning opportunities, have resulted in >200 million children under the age of 5 years not reaching their developmental potential.¹⁰

In everyday life, children must be given a stimulus to help improve and develop their cognitive function from an early age. Playing at an early age for children is very necessary. By playing, the learning process will be effective. One of the playing media for children that functions to stimulate cognitive development is a puzzle game, the benefits of playing are very good for the development of the cognitive side of children.¹¹(Rita Dwi et al., 2020)In this study, the average value of learning achievement for stunting children who were given cognitive stimulation based on a puzzle game was Pre Test 1 = 70.36, Post Test 1 = 69.36; Pre Test 2 = 72.36, Post Test 2 = 69.36, and Pre Test 3 = 74.63, Post Test 3 = 70.72, indicating a change, an increase in stunting student learning achievement as measured for 1 month with cognitive stimulus-based learning methods through puzzle games, according to the results of Mulyana et al's research, the puzzle playing

method on increasing the cognitive development of children aged 4-6 years in Kindergarten Nurul Iman Tasikmalaya, 40 students as respondents, 32 participants (80%) pretest were in the low category, and the posttest results were 26 children (65%) is in the good category; significant $P < 0.01$, there is an effect of playing the puzzle method on increasing the cognitive development of children aged 4-6 years in Kindergarten Nurul Iman.¹²

In the results of statistical tests using the paired T-Test, there were statistically significant differences ($p < 0.05$) for all puzzle game interventions given to stunted children in both the 1st, 2nd and 3rd interventions, including in the total value of the three interventions there is a significant effect on the learning achievement of stunted children. Learning achievement is knowledge obtained in the learning process resulting from tests in several fields of study so as to get results/scores. Learning achievement is the result of evaluating students using assessment tools after a planned learning process is carried out both in material and time and the desired learning achievement is adjusted to the type and function in assessment or measurement.¹³

Game-based learning (Educative Game Tools) can improve students' ability to acquire and construct knowledge in a fun and focused learning atmosphere because it refers to the application of games or related elements, concepts, mechanisms or designs into learning.¹⁴ In addition, game-based learning is a learning mode that integrates educational games into school teaching and independent learning, so that students get an immersive learning experience while mastering knowledge and skills.¹⁵

Many studies show that game-based learning has a positive impact on learner motivation, attitudes, and engagement, engagement and performance. The use of game elements, such as puzzle games can not only increase students' external motivation, but also positively influence students' behavior and increase their internal motivation in subjects and concepts that are difficult for students to understand.¹⁶

In stunted children with chronic conditions, it represents a barrier to children's growth due to long-term malnutrition. Stunting causes obstacles to physical development but also threatens cognitive development which has an impact on reducing children's productivity in adulthood.¹ Toddlers who are born stunted and continue to be stunted until the age of three have lower cognitive development than stunted newborns who are able to reach normal height at the age of three. In addition, children who receive care with poor psychosocial aspects have lower cognitive development compared to good care.¹⁷

So it really needs innovation related to learning methods that can stimulate and stimulate cognitive, memory and brain work in children with stunting. Cognitive ability is one part of a person's brain development, how children can memorize something and can develop perceptual abilities, memory, ways of thinking, and problem solving. Children's cognitive abilities can be demonstrated by carrying out playing activities using game tools that contain educational elements or values, educational elements or values to train the brain in memorizing and solving problems.¹⁸

According to Piaget's cognitive theory, children at the age of elementary school students (7-8 years to 12-13 years) are at the concrete operational stage. In the learning process, children have difficulty understanding something abstract, so children need concrete objects to be able to think logically. The success of a student's learning can be determined based on the learning achievements obtained in the report card indicated by the values in the form of numbers and or letters. Learning achievement is the result of an educational assessment of student progress after carrying out learning activities. Learning achievement in the assessment of report cards always includes three aspects. One of them is the cognitive aspect, where this aspect greatly determines

the achievement that will be obtained by students because cognitive is a process of remembering and thinking that occurs in the brain, so it is indicated that cognitive ability can affect student learning achievement.¹⁹

Psychoeducational stimulation is designed to improve children's cognitive development, social interaction, language, and fine and gross motor skills following an age-appropriate curriculum. In one study, malnourished preschoolers were randomly assigned to an integrated intervention at 4 different ages at a 9 to 10 month interval between ages 42 and 75 months. The intervention ended when the children were 7 years old. The children were assessed periodically during and after the intervention until they were 10.4 years old. Overall cognitive ability (drawn from multiple tests) was superior in the longest intervention exposure group, with substantial cognitive ability in each group according to the duration of intervention exposure, but there were substantial gaps in cognitive abilities when comparing the maximum exposure group to the group of children from families with high socioeconomic status.²⁰

One of the psychoeducational games is to use a puzzle game that arranges a picture or object that has been solved in several parts. Puzzle games are a type of educational game to train children's mindset in assembling pieces into a single unit that has a complete shape. Puzzle is a game of assembling pictures that have not been perfectly arranged into perfect pieces. By playing puzzles, children can train their intelligence and be able to solve problems.²¹

Playing puzzles also has many benefits such as children can train and help their cognitive abilities, can improve fine motor skills, can improve social skills, stimulate the development of creativity, and can improve moral development. Based on the benefits of playing, children will grow and develop optimally. In addition to cognitive development, there are 4 aspects of development that will be stimulated by playing, namely: physical-motor aspects, social aspects, emotional aspects, and language aspects.²²

The results of this study can provide an objective choice for teachers in order to provide cognitive stimulation for children who are stunted. Stunted children need to be given special treatment or intervention so that they can have the same speed as their peers in terms of achieving learning targets at school. So that stunted children can receive learning using methods according to their needs to develop cognitive abilities related to increased thinking skills, problem solving, decision making, intelligence and aptitude.

CONCLUSION

This study shows that there is a change with an increase in stunting student learning achievement with cognitive stimulus-based learning methods through puzzle games, statistically significant, significant for all puzzle game interventions given to stunted children both in the first, second and third interventions as well as the total value of the The three interventions increased the learning achievement of stunted children. Therefore, it is very important to consider cognitive stimulus-based learning methods through puzzle games, as a learning approach technique for elementary school-aged children who are stunted.

CONFLICT OF INTEREST

The authors declare that they have no conflict interests.

ETHICAL CLEARANCE

This research has received ethical approval from the Health Research Ethics Commission (KEPK) Regional Board of the Indonesian Association of Public Health Experts (IAKMI) Southeast Sulawesi Province No. 104/KEPK-IAKMI/IX/2022

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