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Original Research

Impact of Interventions with Modified Snake Ladder Games on Cognitive Abilities and Reducing Cognitive Decline in Aging

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ABSTRACT

Background: *Aging is the process by which humans slowly lose the capacity of their tissue to improve. Elderly people experience physical, mental, and social decline as well as a decrease in cognitive function. To maintain cognitive abilities, interventions in the form of cognitive activities are needed. The purpose of this study was to determine the effect of a cognitive game in the form of a modified Indonesian version of the Snakes and Ladders board game on cognitive abilities.*

Methods: *This research is quantitative research with a pre-experimental design with one group pre-post test. The sampling technique used was purposive sampling with a sample size of thirty people. The instrument used was the MoCA-Ina. The cognitive game Modified Snakes & Ladders Indonesian version was carried out in 8 sessions over 18 weeks. Data analysis using paired t-test.*

Results: *The research sample shows that the characteristics of age are dominated by female middle-aged elderly, and the characteristics of the sample with a final elementary school education are 14 people. Paired t-test results Sig. (2-tailed) = 0.000, which means p-value <0.05. It shows that a cognitive game in the form of a modified Indonesian version of the Snakes and Ladders board game has an effect on cognitive abilities.*

Conclusion: *The modified Indonesian version of the Snake Ladder Game is one of the board games used in activity therapy that can be used for cognitive function in the elderly.*

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INTRODUCTION

Research results from the Indonesian Central Bureau of Statistics 2022 show that Indonesia has moved to an old population structure starting in 2021. For more than a decade (2010-2021), the proportion of elderly people increased by approximately 3 percent to 10.82 percent. The *World Health Organization* (WHO) in 2022 states that an

elderly person is someone who has reached the age of more than 60 years and above (BPS, 2024).

Zainurridha et al., (2020) state that the elderly experience problems that often occur in addition to physical and psychological decline, namely cognitive function. Pranata et al., (2020) state that cognitive function is the ability to integrate sensory input in the form of perception quickly, where perception is an interpretation that is input from the external by the brain from a pattern of nerve impulses given through receptors. Cognitive impairment in the elderly is needed so that it can process and integrate senses and can communicate and respond well.

Cognitive functions include perception, comprehension skills, language use, the ability to count, attention, memory, executive functions, and learning processes, so that this causes the reactions and behaviour of the elderly to be delayed (Ramadhani, 2019; Kuo et al., 2018). Akhmad et al., (2019) describe that the prevalence of elderly people who experience cognitive impairment is 17-34%. This decrease in cognitive function can be caused by depression, neurological diseases, and diabetes. Some studies state that cognitive decline can affect the quality of life of the elderly, resulting in dependence on others (Puspitosari & Putri, 2024; Azizah, 2020).

The impact of decreased cognitive function on the elderly is often forgetting their identity and forgetting the names of family members, the elderly are difficult to carry out their daily activities such as eating, drinking, bathing, productivity, and can affect the level of independence in the elderly (Estrada et al., 2021). Shiddieqy et al., (2022) which occurs can reduce the ability of the elderly to ADL, IADL, and social participation. Akhmad et al., (2019) explained that the cognitive decline of the elderly caused the elderly to experience a decrease in independence and good functional capacity.

For social participation, it is impaired due to reduced cognitive function of the elderly in managing memory abilities, word selection and it is difficult to express their thoughts and it becomes difficult to maintain social relationships. In the elderly, decreased cognitive function causes reduced ability to remember, problem solving, productivity and affects the level of independence in the elderly (Puspitosari & Putri, 2024). One of the efforts that can be made to reduce the decline in cognitive function is to provide exercises that are useful for cognitive abilities in the elderly (Triyulianti & Ayuningtyas, 2022).

There are various kinds of activities that can be given in reducing the risk of decreased cognitive function in the elderly. Those activities requires thinking activities, including reading newspapers, playing puzzles, watching news on TV, or games that can sharpen the brain such as snakes and ladders, ludo, chess, monopoly and others (Ayuni et al., 2022; Patricia, 2016; Kuo et al., 2018). Snake ladder game is a traditional game that uses some equipment such as dice, pawns, and snake ladder boards.

Modified Snake Ladder Game is one of the media used in therapeutic activities that can be intended for cognitive function in the elderly. In addition, modified snake ladder game in therapeutic activities can be specially modified so that it can adjust the right concept in reducing the effects of cognitive decline. The difference between the snake ladder game and the modified snake ladder game lies in the challenges in each numbered box.

The challenges are in the form of questions modified from MoCA-Ina instruments such as memory and problem-solving skills. Players who are able to answer the challenge will step according to the number obtained. Modified snake ladder game can

also invite players to sharpen their brains by thinking in solving existing problems and in the process of the game intertwined in the social interaction of the players (Altuntas et al., 2017; Frisca et al., 2020).

Based on the explanation above, it is important to know the effect of the cognitive game in the form of a modified Indonesian version of the Snakes and Ladders board game on the cognitive abilities. Research on a modified snakes and ladders game specifically to improve cognitive abilities in adults has never been done before.

MATERIALS AND METHOD

This research uses a quantitative method with a one-group pretest-posttest design. The population in this study was thirty people, in Kudu Village, Baki, Sukoharjo. The sampling technique used is the purposive random sampling method. In this study, the Montreal Cognitive Assessment versi Indonesia (MoCA-Ina) questionnaire was used to measure cognitive abilities.

The instrument has been tested for validity and reliability by Panentu & Irfan, (2023) on 20 respondents aged 45 to 56 years at RSUP. Dr. Moh. Hosein Palembang with the results of the Indonesian version of the MoCA instrument declared valid and reliable. The results of the validity of the MoCA-Ina value are r = 0.529 and p = 0.046; reliability results obtained value r = 0.963 and p = 0.000. MoCA-Ina measures eight categories of cognitive abilities, including alternating trial making, naming, memory, forward digit span, backward digit span, attention, serial 7s, language, abstraction, and orientation.

The intervention was carried out by giving cognitive stimulation activities modified snake ladder games. Game modifications were made by researchers in the game rules section by providing 100 cognitive question challenges and placing them on each number. The following are the game rules that have been modified, namely: 1. If a number is obtained, the elderly person answers questions given. 2. If you get up (ladder) or down (snake), then elderly people answer the questions given. 3. If you get a snake (snake) down, the elderly person answers the questions given, and then the elderly person doesn't need to come down, so just stay there.

When the player throws the dice, they then continue to get the numbers obtained, which are given a challenge in the form of questions containing questions that require cognitive abilities of the elderly in aspects of memory, thinking, judgement, problem-solving skills, and abilities in a day, date, month, year, place, and city orientation. The questions were taken and modified from the screening items on the MoCA-Ina instrument. The board has been modified to be larger, 92 x 65 cm, played by 8 elderly people, the dice using material made from flannel pillows 10 x 10 cm, jumbo-sized tub. These cognitive stimulation activities were done 18 times (once a week, 40-50 minutes for 18 weeks).

Data analysis used an independent sample t-test because the data were normally distributed with a significance value > 0.05. Ethical clearance was obtained from the Health Research Ethics Committee Dr. Moewardi General Hospital number 700 / V / HREC / 2024.

RESULTS

This research was conducted in the community in the Sukoharjo district from June to September 2024. Distribution of respondent characteristics based on age, gender, and education categories.

Table 1. Distribution of respondent Characteristics

Characteristic	Frequency (n)	Percentage (%)
Age category by WHO		
Middle age (45-54 years)	5	16.7
Elderly (55-65 years)	13	43.3
Old (>66 years)	12	40.0
Gender		
Male	4	13.3
Woman	24	86.7
Education level		
Primary education	21	70.0
Higher education	9	30.0

From the results of the table above, it is shown that elderly age is being dominated in this study. Gender-dominated is female, and in the last education is dominated by a primary education.

Table 2. Mean cognitive abilities *pretest-posttest*

	n	Mean	St. Dev
Pre Test	30	17,50	2,224
Post Test	30	21,13	2,177

Based on Table 2, the results of the cognitive ability showed an increase in the mean value (before and after intervention), namely 17.50 to 21.10, with a difference of 3.63.

Table 3. Normality test MoCA-Ina

	n	Nilai ρ
Pre-test MoCA-Ina	30	0,211
Post-test MoCA-Ina	30	0,265

Table 3 shows the normality test results, which obtain the results of the normally distributed data.

Table 4. Paired t-test results

Result	Paired Sample t-test		Information
Pretest and pretest	n	Sig. (2-tailed)	meaningful
MoCA-Ina	30	0.000	

Based on Table 4, it can be seen that after the intervention, the results of the pretest and posttest p-value = 0.000 ($p < 0.05$). This shows that there is an effect of cognitive games in the form of a modified Indonesian version of the Snakes and Ladders board game on cognitive abilities.

DISCUSSION

Interventions using cognitive games Snakes and ladders games have been shown to improve cognitive function in the elderly (Viaroza, 2024). The application of an Indonesian version of the modified snake ladder game has the effect of stimulating cognitive function in the elderly (Wahyudi et al., 2024). Snack Ladder Game has a

significant effect in improving cognitive abilities in the elderly (Ayuni et al., 2022). Intervention using the snake ladder game can reduce the risk of cognitive impairment (Kuo et al., 2023).

In this study, the total intervention given to the elderly was eighteen intervention sessions with an intervention frequency of once a week with a duration of thirty minutes. Cognitive activities can function as cognitive activities that can be carried out in this research using the snake ladder game. The snake ladder game is a traditional game played by more than two players made from filled paper lines of small boxes, and in some boxes, a number of stairs or snakes are drawn that connect the players to other boxes using the rules of the game (Chang & Wu, 2024). The snake ladder game can improve emotional control abilities (knowing defeat and winning), problem-solving (solving problems), competition (waiting your turn), and improving cognitive abilities (remembering game rules).

The intervention carried out in this research was in the form of a modified snake ladder game with the aim of improving cognitive abilities in the elderly. The modified Snake Ladder Game carried out in this research is a game that has been modified as a result of changing its original state by changing an existing game or creating a game that did not exist before. The intended function of the changes is to provide an impact on players during the process so that it is easy and interesting to improve cognitive function abilities in elderly individuals (Yang et al., 2019). The modified Snakes and Ladders game is a game that improves the memory abilities of elderly people. Useful for improving the cognitive abilities of elderly people in terms of memory, training the brain's ability to think complexly, and practicing problem solving and decision-making (Viaroza, 2024).

In language skills that can be stimulated by this game, for example, vocabulary is "up and down, back and forth, up, down, and so on". Language skills function so that the elderly maintain language skills in fluency, comprehension, repetition, and memory; abstraction skills function for the ability to think logically and critically in pre-elderly & elderly. Delayed recall functions in short-term memory and orientation skills function to reduce the risk of disorientation in the elderly of place and time in pre-elderly & elderly. Executive ability, memory, naming, attention, language, abstraction, recall, and orientation are factors that indicate a person's cognitive function ability (Zainurridha et al., 2024).

Social skills trained in this game include the willingness to follow and obey the rules of the game, such as playing in turns. The elderly who are active in social interaction with others or have emotional attachment by providing a response in social interaction will have a good cognitive function (Situngkir et al., 2022). Apart from that, cognitive skills include stimulation that states the sequence of numbers, recognizing number symbols and number concepts, and playing the modified snake ladder game, which is used to combine elements of strategy, colour, visuals, and shapes that are suitable for the elderly (Tracene et al., 2023). Researchers modified the size of the board and dice to suit a larger size to make it easier for the elderly to see when playing the game.

Apart from that, there are also modifications to the facilities and rules of the Snake Ladder Game (Sikhah, 2018). There are 100 questions that will be randomized every week. Then you will be given a challenge in the form of questions in each box. Elderly people are asked to answer these questions to be able to move according to the numbers that appear on the dice. The cognitive questions given can be useful for the

cognitive abilities of the elderly, including questions that refer to cognitive sub-tests in the form of visuospatial/executive abilities, naming abilities, memory abilities, attention abilities, language abilities, abstraction abilities, delayed recall, and orientation abilities. memory, abstraction abilities function for logical and critical thinking abilities in the elderly (Puspitosari & Putri, 2024; Wahyudi et al., 2024).

The implementation of the intervention using the Modified Snake Ladder Game was carried out by dividing into five groups for each game session, where the samples were divided into eight people in one group. Each group session has different people, so players experience playing with different people. The mechanism of effectiveness of the cognitive games is that while playing the game, not only is the modified snake ladder game entertaining, but it is a game that can connect social interactions with other people because in each session the elderly will interact well when throwing dice, helping other players who are having difficulty, and chatting with each other.

During the game, you can improve problem-solving by stimulating the brain, which is responsible for forming memories, thinking about strategies when throwing the dice, and remembering what numbers have been thrown. This game can train the cognitive functions of the elderly when playing it to reduce the effects of loneliness in the elderly (Fernandes et al., 2022; Yang et al., 2022). This intervention can incorporate various cognitive functions such as attention, concentration, response speed, perception and memory, orientation, verbal and linguistic skills, mathematical concepts, and problem solving, including concept formation and executive functions. The primary limitations to the generalization of these results are sample size, proportion of sample characteristics, and Javanese cultural bias. Some samples were less proficient in Indonesian, so the researcher had to re-explain in Javanese.

CONCLUSION

The results of the study show that there is an influence of providing cognitive stimulation interventions on cognitive abilities. The types of interventions that can be used are those that use game media, which are useful for solving psychological problems and can help with cognitive recovery as well as dealing with the mental health of the elderly. The use of snake ladder games is also effective in improving cognitive function and motor function in the elderly; this can be seen from the activeness, social interaction, and joy felt by the elderly.

Apart from that, the elderly feel the benefits of physical fitness, and the elderly come to understand that the brain must continue to be trained to maintain cognitive function and memory. The modified Snakes and Ladders game is one of the media used in activity therapy that can be used for cognitive function in the elderly. Besides that, the modified snake ladder game in therapy activities can be modified specifically so that you can adjust the right concept to reduce the effects of cognitive decline. Further research, one can modify other cognitive games such as Monopoly, Ludo, and other cognitive games.

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