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Arbi Care as an Educational Game to Improve Knowledge in Diarrhea Prevention among Preschoolers

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Abstract. Diarrhea is still the second highest cause of the death in children under five in the world. Innovation programs continue to be sought to reduce the number of child death due to diarrhea and help diarrhea prevention in Indonesia. This study aimed to examine the effectiveness of educational games called as Arbi Care on diarrhea prevention towards the knowledge of healthy behavior among preschoolers. This study used pre-post test control group design involving 120 participants whom fit the inclusion criteria. Participants were randomly divided into a control group of 60 participants and the intervention group consists of 60 participants. Data were analyzed using one-way MANOVA test. The results showed there were significant mean differences in knowledge of healthy behavior to prevent diarrhea between control group and intervention group. There was also a different increased inclination of mean score which is intervention group score higher than control group. Arbi Care is effective in improving the knowledge of healthy behavior to prevent diarrhea among preschoolers. Thus, Arbi Care is recommended to be the model to help prevent diarrhea in children using educational game.

1. Introduction

Problems related to children's health have been serious issues to solve in all over the world. This urgency can be seen from one of the goals Millennium Development Goals (MDGs) especially point 4 which is to decrease child death rate. At this presence, it was estimated that about 5.1 million children died from preventable diseases. Because of those issues, decreasing the child death rate still remains target of the third aim of Sustainable Development Goals in 2030. [1,2]

Among ASEAN countries, Indonesia ranked number 4 of countries with the highest number of children under five death [3]. The main causes of children under five deaths across the world are pneumonia with 18% and diarrhea that reaches 15% [1]. Sub-Directorate of Diarrhea in Indonesia stated that diarrhea has been number two death cause of child under five deaths, number three to infant deaths and number five to people in all ages. Diarrhea suffering rate in children under five increased year after year. IBHS in 2002-2003 it was found that 11% of children suffered diarrhea 2 weeks before the survey. In 2007, it got increased to 13.7% and 14% in 2012 [4,5]. South Sulawesi was a province with the highest rank of children suffering from diarrhea among eastern provinces of Indonesia based

on SKDI in 2012. City of Makassar was the area with the highest number of diarrhea cases in this region for three years from 2008 to 2010. [6]

Various studies explained that the causes of diarrhea are poor behavior hygiene and health practices. The children behaviors that contribute directly to the number of cases of diarrhea are *washing hands with soap* act (CTPS) and unhealthy pattern of snack consumption [7,8,9]. Both hands are main entrance for disease germs into the body because hands are body parts that get in touch the most with mouth and nose [10]. The habit of washing hands with soap or hand sanitizer can decrease diarrhea cases up to 50% or equally it saves about 1 million children lives around the world every single year. [11]

Government's efforts to enhance clean life behavior had been contained in the programs of Subdit diare which one of them was enhancing effective preventive actions in the form of healthy life promotion. Pre-research study that was done by the researchers in March to April 2014 of three hospitals in the City of Makassar showed that there were obstacles in healthcare promotion activities to control the diarrhea cases. The obstacles were non-existing procedure of healthcare promotions, high quantity of work burden for nurses that caused limited time for educative activities, and the targeting of the educative activities that at this presence, focused only to adults and family, not to children. This could be seen by the fact that education media for children in the hospital did not exist.

Based on the issues formulation above, the researchers were eager to research on effectivity of Arbi care intervention toward improvement of preschool students' knowledge about diarrhea prevention by healthy habits.

2. Experimental Details

Research design that was applied in this research was pure experiment with *time series design* approach. Intervention group was given treatment in the form of educative diarrhea prevention game given for 25 minutes. It was conducted twice a week in 5 weeks period. This was based on previous research which used video game to encourage healthy life behavior to prevent diabetes on children. [12] The same thing was stated by Pender, Murdaugh and Parsons explaining that effectivity in healthcare promotions needed to be measured repetitively especially after just intervention was given (short term), after intervention was given where changes were observable (immediate term), and in time where life style changes were expected to happen (long term). Control group in this research also obtained the same intervention after week 10 posttest. [13]

The research subjects in this research were preschool students at three Kindergartens in Makassar. Research subjects were selected based on some inclusive criteria those were; (a) children from 4 to 6 years old, (b) children who could utilize and play game on cellphone or tablet, and (c) those who were willing to be respondents and acquired permissions from their parents. The exclusive criterion was children who had focus and behavior issues.

Research subject selection was conducted through three phases: (1) picking schools with hand wash facilities; (2) three schools possessing all of the inclusive criteria were given pretest to their students who possessed all above inclusive criteria; (3) then, from all selected schools randomization was conducted to decide members of both intervention and control groups using random table; and (4) from all of the three schools, 120 students were taken for then to be divided 60 students in intervention group and 60 students in control group.

3. Results and Discussion

Descriptive analysis was described as follows: (1) Description of every item score before and after given intervention to both intervention and control group; and (2) Description of knowledge of every item in every measurement phase after giving intervention to intervention and control groups. Table 1 show was the description of mean score of knowledge in every item before and after Arbi care intervention given to intervention and control groups. it can be seen that knowledge item that reached maximum score (score 10) after giving intervention was in children's knowledge about washing hands before eating for both groups and washing eating and drinking tools before reusing them in

intervention group. The highest score improvement in intervention group was seen in throwing away food that fell into the ground item with 7.0 mean score and choosing unbalanced nutritious food item with 7.4 mean score. The same thing also happened in control group but it was not as significant as improvement in intervention group.

Table 1 Description of Knowledge of Every Item Before and After Arbi care Intervention Was Given to Intervention Group and Control Group

No	Knowledge item	Intervention Group			Control Group		
		Pre	Post	Δ	Pre	Post	Δ
1	Washing hands before eating	9,8	10	-0,2	9,3	10	-0,7
2	Washing hands after coming back from toilet	9,1	9,8	-0.7	8,8	9,0	-0,2
3	Throwing food that fell into the ground	2,1	9,1	-7,0	2,1	5,1	-3,0
4	Washing eating and drinking tools before reusing	9,3	10	-0,7	9,3	9,6	-0,3
5	Reusing eating tools that fell into the ground	9,3	9,7	-0,4	9,0	8,3	0,7
6	Choosing healthy and balanced nutritious food	9,3	9,7	-0,4	8,5	9,3	-0,8
7	Choosing unbalanced nutritious food	2,3	9,7	-7,4	3,0	4,0	-1,0
	Knowledge mean score	7,3	9,7	2,4	7,1	7,8	0,7

All these discoveries entirely showed improvements of mean score in all knowledge items about healthy habit of diarrhea prevention after Arbi care intervention was given for 25 minutes, twice a week in 5 consecutive weeks long. Knowledge improvement in intervention group reached 2.4 points comparing to control group which was only 0.7 or in other words, the score improvement in intervention group was three times bigger than control group.

Shown from Table 2 was mean score description of every knowledge item among measurement times after Arbi care intervention was given to both intervention and control groups. It was known that knowledge score in intervention group on items such as washing hands after coming out from the toilet, throwing away food that fell into the ground, and reusing the eating equipment that fell got decreased after one month of intervention (post3). Similar thing also happened in control group where knowledge items such as washing hands after coming to the toilet and throwing away food that fell into the ground also experienced decrease.

Table 2. Mean Score Description of Every Knowledge Item Among Measurement Times after Arbi care Intervention to Intervention and Control Groups.

No	Item of knowledge	Intervention Group			Kelompok Kontrol		
		Post1	Post2	Post3	Post1	Post2	Post3
1	Washing hands before eating	10	10	10	9,3	9,6	10
2	Washing hands after coming back from toilet	9,8	9,6	9,5	8,8	9,4	9,3
3	Throwing food that fell into the ground	9,1	10	9,5	2,1	4,4	4,0

No	Item						
4	Washing eating and drinking tools before reusing	10	10	10	9,3	8,9	9,6
5	Reusing eating tools that fell into the ground	9,7	10	9,6	9,0	8,6	9,1
6	Choosing healthy and balanced nutritious food	9,7	9,6	10	8,5	9,3	9,8
7	Choosing unbalanced nutritious food	9,7	10	10	3,0	4,0	5,2

Shown from Table 3 was knowledge score difference between the two groups before and after intervention was given at times. Repeated measurements were given three times which were after giving intervention, two weeks after intervention, and one month after intervention was given. *General Linear Model Repeated Measure* (GLMRM) test results above showed that mean score difference between intervention and control groups before given intervention was not significantly different ($p=0,449 > \alpha=0,05$). On the other hand, after Arbi care intervention was given (post1), it could be seen that there was significant difference in terms of knowledge mean score in both groups ($p<0,001$). It was consistently similar with what was found in the second and third posttest with p value respectively $<0,001$. Knowledge mean score improvement after given Arbi care intervention (posttest1) on intervention group was three times higher comparing to control group. In intervention group, the score improvement was 32,11% while in control group, it was just 10,47%. This discovery showed that Arbi care intervention was proven to be effective in improving preschool students' knowledge about healthy habit to prevent diarrhea.

Table 3. Mean Score Difference in Every Item of Knowledge of Healthy Habit Preventing Diarrhea Inter-measurement Times of Intervention and Control Groups in Makassar January-April 2016.

No	Item of knowledge	Intervention Group			Kelompok Kontrol		
		Post1	Post2	Post3	Post1	Post2	Post3
1	Washing hands before eating	10	10	10	9,3	9,6	10
2	Washing hands after coming back from toilet	9,8	9,6	9,5	8,8	9,4	9,3
3	Throwing food that fell into the ground	9,1	10	9,5	2,1	4,4	4,0
4	Washing eating and drinking tools before reusing	10	10	10	9,3	8,9	9,6
5	Reusing eating tools that fell into the ground	9,7	10	9,6	9,0	8,6	9,1
6	Choosing healthy and balanced nutritious food	9,7	9,6	10	8,5	9,3	9,8
7	Choosing unbalanced nutritious food	9,7	10	10	3,0	4,0	5,2

The results of this research showed that Arbi care intervention was effective in improving children's knowledge about healthy habits to prevent diarrhea comparing to control group after one week, two weeks, and even one month after educative intervention with p score was $<0,001$. This

phenomenon was seen from the mean score improvements in intervention group which was 32,11% while in control group it was just 10,47%.

Game was proven effective in improving knowledge, self-efficacy and hand washing practice of children with disabilities. [14,15,16] Preschool students that play game could learn the scientific concepts through fun game playing experience more than just having fun. From the meta-analysis done by Wouters *et al*, it was concluded that games could be proven as effective media for learning. [17]

Teed explained the reasons why games become one of the effective methods in learning activities in a research about *Game-Based Learning* (GBL). That reason was mainly because games can motivate students to learn. Games are fun, sinking them into the learning material to learn more effectively and pushing students to learn from their mistakes. [18] These reasons proved that game was the perfect method to be used in enhancing children's knowledge. Games could be used as one of the methods in improving knowledge for children in early age so that expectedly it could affect the forming of a supportive habit in upgrading the health degree and for it to be more permanent for the children in the future.

Based on Bandura's social cognitive strategy, it was stated that to enhance healthy habit, self-efficacy needed to be upgraded first. However, self-efficacy could be well constructed if there was also god quality knowledge. Because of that, to change behavior, the first thing needed to be built was good understanding. In this point, cognitive area became the main entrance to start changing or growing a healthy behavioral practice. [19]

From this research it was also known that children's knowledge after intervention given, whether it was in first measurement, second measurement, even third measurement, did not show any significant difference. This phenomenon showed that education from Arbi care was well planted during the process of the research making it was difficult to be forgotten by the children. This also supported the theory that well planted concept in preschool period would give positive habits and behavior in the future.

Based on knowledge mean score graphic after Arbi care intervention was given in the second measurement it was visible that knowledge score improvement in intervention group was higher than control group. Knowledge for children in intervention group was very consistent in times, especially in two weeks intervention even until one month post intervention. However, in one month after intervention, knowledge score in control group also improved while in intervention group it remained constant.

This phenomenon happened because intervention group had reached the maximum score of knowledge improvement measurement, while control group approached the maximum score one month after intervention. This condition could happen because there was interaction between intervention and control group in the same school where it was possible that members of intervention group shared what they knew from playing the game to control group members. One month period where control group experienced knowledge improvement indicated the period needed for information transfer process from one preschool students one to another.

4. Conclusion

Arbi care game that given 25 minutes three times a week was effective in improving knowledge about healthy habits to prevent diarrhea of preschool students. Arbi care is recommended for becoming model/instrument to help preventing diarrhea for preschoolers. This game can be further developed for elementary school in different aims and topic.

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