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Virtual Posyandu Program during the Pandemic Maintained Children's Growth and Development

Program Posyandu Virtual di Masa Pandemi Mampu Menjaga Tumbuh Kembang Anak

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ABSTRACT

Background: *Posyandu* program suspension due to COVID-19 has resulted in a decrease in monitoring children's growth, leading to undetected problems. Understanding mothers' eating behavior plays a crucial role in preventing malnutrition, we must continue the program as a health promotion medium to enhance mothers' understanding and track children's growth and development.
Objectives: This research aimed to determine the effectiveness of virtual *Posyandu* program in strengthening cadre health promotion services for nutritionally vulnerable children in Jember Regency agricultural area during the absence of offline *Posyandu*.
Methods: The research was carried out September 2022-January 2023, implementing a 21-day intervention on 169 respondents from *Puskesmas* Arjasa and Paleran (representing two different socio-cultures). The cadres utilized the application to enhance children's nutritional health and instruct parents on its usage. The success parameter is that there were significant differences between the growth and development of children pre- and post-program. Growth variables were assessed by measuring nutritional status according to Ministry-of-Health Regulation, before and after the intervention, while development variables were assessed using a Developmental Pre-Screening questionnaire (DPSQ).
Results: The virtual *Posyandu* program in both *Puskesmas* demonstrated significant differences ($p<0.001$) in children's growth and development parameters, such as height-for-age, weight-for-height, and DPSQ, between the pre- and post-program periods. Despite the challenges posed by the pandemic, the program has effectively maintained children's growth and development.
Conclusions: Balitagrow© Android-based application in virtual *Posyandu* program effectively maintained children's growth and development in pandemic era and worth continuing to be developed according to user needs.

INTRODUCTION

The results of the 2022 Indonesian Nutritional Status Study showed the distribution of children experiencing malnutrition in Indonesia is most common in children aged 0-59 months and located in rural/agricultural areas[1]. It is suspected that the cause is not due to the unavailability of food in agricultural areas but rather the choice of food that is less suitable to meet the needs of children based on their age[2–4]. According to our previous study, mothers' adequate knowledge of eating behavior may prevent the occurrence of stunting and undernutrition in children under five (CUF)[5].

The prevalence of nutritional problems, which can cause stunting, malnutrition, and even indirectly result in a child's death, has been connected to various socioeconomic factors such as parenting style feeding, parental knowledge, customs, etc. In an effort to develop formulas for nutritional health promotion, prevention, and rehabilitation through dietary change, this has led to numerous studies and thorough searches[6–8]. According to Arini, one reason for CUF's good nutritional status is their toddlers' eating patterns, which include varying the foods they eat. Thus, wealthy households that don't invest the time to properly raise their children may also experience low-quality food intake and food and nutrition issues[9].

A holistic approach to improving nutritional quality can begin with primordial, primary, secondary, and tertiary preventive measures. This includes providing nutritional knowledge and awareness (through gadgets, lectures, and multimedia information), as well as production, diversification, and consumption of nutritious foods. To reduce the occurrence of malnutrition, we need to implement intensive preventive interventions, such as enhancing the role of cadres in the *Posyandu* program and leveraging technology to effectively communicate information to parents.

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Posyandu program is a community-based program in Indonesia, that is implemented in each working area of *Puskesmas* (Public Health Center), that aims to improve maternal and child health by providing health services, including monitoring the growth and development of CUF years old[10]. In the pandemic era, most of the *Posyandu* programs were absent because the risk outweighs the benefit.

The delay of the *Posyandu* program at the beginning of the COVID-19 pandemic led to a 67.76% decrease in monitoring the growth of CUF[11]. The availability of the *Posyandu* program has been associated with child weight status in Indonesia[12]. Although the pandemic era has come to an end, , the innovation of a virtual *Posyandu* program needs to be considered for its benefit in helping mothers monitor their children's development[13]. Parents can access several applications at home, including "Balitagrow©", "*Pengecekan Status Gizi*", "*Kalkulator Gizi*" and "*Primaku*". Parents can download the application on their smartphone from the Google Play Store to monitor their children's growth and development at home. Balitagrow© is not only monitoring growth parameters but also providing nutritional management recommendations in the form of education and daily nutritional advice. Therefore, this research aimed to determine the effectiveness of virtual *Posyandu* program in strengthening cadre health promotion services for nutritionally vulnerable children (CUF) in the agricultural area of Jember Regency during the *Posyandu* break in Pandemic era.

METHODS

This study used a community trial design in Arjasa and Paleran Public Health Center working area with high levels of stunting. Prevalence of stunting in Arjasa District in 2022 was 10.61% which is one of 11 districts with a prevalence of stunting above the target. From several Public Health Centers in Jember, unfortunately Arjasa and Paleran are home to stunted toddlers. These two places were chosen to represent an agriculture area with two different socio-culture conditions, given that Jember City is home to two major ethnicities or communities that could potentially yield different results. When designing clinical research for chi square analysis with a predicted risk ratio of 2 and a predicted proportion of cases not receiving intervention of 0.3, sample size calculators came up with 152 as the minimum number of cases. A total of 169 samples (83 samples in control group and 86 samples in intervention group) were randomly selected by cadres from the *Posyandu* members. The *Posyandu* members who have lived in those two districts for at least 1 year, have a child under 5 years old, have an Android phone, have internet access, and can communicate well were included in the criteria. We excluded them if they couldn't participate in the research until its completion.

We conducted the research at multiple points in time, from September 2022 to January 2023. We introduced the application to both groups during this period, but only the intervention group received help in using it. The intervention, which lasted 21 days, involved cadre partners and the use of the Balitagrow© application, which our team developed to promote nutritional health for CUF and instruct parents on its use. For example, if one respondent started on October 1, the respondent would finish on October 21, and if it started on December 2, it would finish on December 22, and so on. The research team monitored the Balitagrow© application usage through the application master website (Figure 1), Whatsapp© groups, and regular Zoom© meetings. Several features used from the Balitagrow© application was Nutritional Status (Calculator), Diagnosis of Nutritional Status, Recommendations in educational videos and short articles, Daily Nutrition (Type of food) filled for 7 Days, Type of food deficiency, and food recommendation. These features were designed to help parents better understand their children's nutritional requirements and improve their implementation. Growth variables were assessed by measuring nutritional status according to Ministry of Health Republic of Indonesia Regulation, before and after the intervention, while development variables were assessed using a Developmental Pre-Screening questionnaire (DPSQ)[14,15]. The interpretation of DPSQ results determines whether the child's development is suitable, uncertain, or deviant. We then analyzed all data using the Fisher exact test, ensuring a p-value of less than 0.05 due to some cells having fewer than five. All protocols done in this research had been approved by the institutional ethic committee of Faculty of Medicine, University of Jember (No. 1624/H25.1.11/KE/2022).

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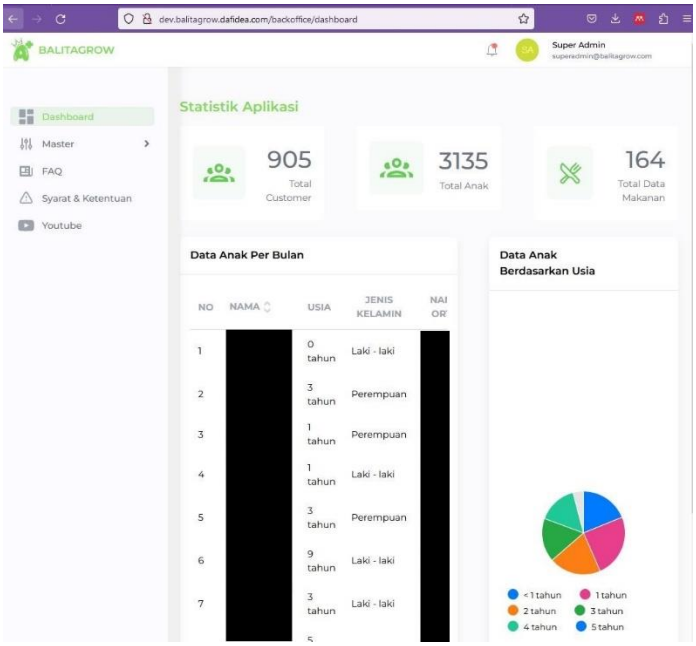

Figure 1. Monitoring through the web master of the Balitagrow© application

RESULTS AND DISCUSSIONS

Table 1 displays the characteristics of the respondents' mothers. The majority of the respondents' mothers are aged 26–35 years, while the respondents are aged 25–48 months. The majority of mothers' education is high school or equivalent, while the majority of their jobs are housewives. There is a balanced distribution of respondents between males and females.

Table 1. Characteristic of respondents' mothers and respondent

Characteristic	n	%
Respondents' mothers		
Age (year)		
19-25	55	32.54
26-35	96	56.81
36-45	18	10.65
Occupation		
Housewife	130	76.92
Employees/laborers	16	9.47
Unemployed	1	0.59
Teacher	5	2.96
Self-employed	17	10.06
Education		
No education	1	0.59
Elementary school/equivalent	17	10.06
Middle school/equivalent	41	24.26
High school/equivalent	92	54.44
Diploma	5	3.71
Bachelor/Graduate	13	7.69
Respondents		
Gender		
Female	85	50.30
Male	84	49.70

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Characteristic	n	%
Age (month)		
6-24	61	36.09
25-48	80	47.34
49-60	28	16.57

The growth and development of respondents before and after the virtual *Posyandu* program is shown in Table 2. The growth of respondents was evaluated by three variables, as for the development was evaluated with one variable. The results can be compared between the control group and the intervention group. Unfortunately, some of the respondents had been categorized as severely stunted, severely wasted, severely underweight and deviant.

Table 2. Growth and development of respondents pre and post virtual *Posyandu* program

Variable	Pre-Program		Post-Program	
	Control (n)	Intervention (n)	Control (n)	Intervention (n)
Height-for-age				
Tall	2	1	2	1
Normal Height	55	66	55	66
Moderately Stunted	17	10	16	9
Severely Stunted	9	9	10	10
Weight-for-age				
In Risk of Overweight	2	4	2	4
Normal Weight	74	73	74	74
Underweight	6	9	6	8
Severely Underweight	1	0	1	0
Weight-for-height				
Obese	6	5	6	6
Overweight	3	1	2	0
In Risk of Overweight	8	6	8	6
Normal Weight	59	66	59	67
Moderately Wasted	7	7	7	6
Severely Wasted	0	1	1	1
DPSQ*				
Suitable	66	42	72	58
Uncertain	14	34	9	20
Deviant	3	10	2	8

*DPSQ (Developmental Pre-Screening Questionnaire)

The growth and development levels of CUF in the virtual *Posyandu* program can vary significantly[11,15]. To support the growth and development of CUF, it is important to create and maintain healthy environments, implement hygiene practices to prevent disease, and provide healthy nutrition and physical activity. Additionally, it is important to create developmentally appropriate indoor and outdoor learning environments, select and use materials to engage CUF, and create responsive schedules and routines to nurture CUF. Understanding the physical development of CUF, developmental milestones, and planning environments and experiences that support motor skills are also important. All of those knowledges can be acquired from *Posyandu* program.

This research was a community trial design, therefore there are many confounding factors. The respondents in both groups live in the neighboring area and are facilitated by the same *Posyandu* resulting in the inability to control the interactions between control and intervention respondents. For CUF, stunting and/or undernutrition represent a prolonged dietary deprivation. The height-for-age index provides historical nutritional status for CUF. Beyond these considerations, a variety of factors influence the occurrence of malnutrition disorders, such as varying socio-cultural backgrounds that may have an impact on dietary patterns. According to Özen et al, there are behavioral differences between families with the same low economic income but differing nutritional statuses of

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CUF. Specifically, mothers of CUF who are well-nourished add extra food to their children's diets by bringing in shrimp and crabs from the river and protein-rich sweet potato leaves[16]. Two-thirds of Vietnamese children gained weight as a result of adopting behaviors influenced by this experience, and after two years, 85% of them were no longer malnourished[17]. The empowerment of low-income households varies from that of other underprivileged families[18,19].

The ability of families to make the best use of their current resources in order to meet the nutritional demands of CUF suggests that providing suitable training in technology to underprivileged populations is essential, primarily to address the issue of malnutrition in CUF[20]. We tried to compare the results from two Public Health Center working areas in both groups, finding no significant difference in all parameters in the pre-program, but significant differences in all parameters in the post-program (Table 3). This demonstrated that the post conditions of the intervention group differ from those of the control group, despite the fact that the two groups were equally significant when comparing pre- and post- intervention data. It can be concluded from Table 2 that there was nutritional status and development improvement in both control and intervention groups, with the intervention group showing a stronger trend.

The virtual *Posyandu* program is designed to maintain the growth and development of CUF, even in the absence of *Posyandu* during the pandemic era. The program includes activities such as health education, monitoring intake or daily nutrition, and monitoring the growth and development of CUF. The program also involves the use of mobile applications such as Balitagrow© to monitor and improve the quality of data collected and give nutritional information that cadres or mothers can assess at any time. The application boasts numerous features including a feature that suggests recipes based on the diagnosis of unmet nutritional needs, a recapitulation of food frequency, and a calorie counter, among others. Growth parameters were also recorded by using Balitagrow© application including height-for-age, weight-for-age, and weight-for-height. Cadres use the WA group to monitor the children in the intervention group's food consumption, physical activity, cleanliness habits, and overall health. They also received health education messages each time they used the Balitagrow© app.

In both Public Health Center working areas, we used the Fisher Exact Test to find that all of the children's growth and development parameters were different before and after the virtual *Posyandu* program (p=<0.001, data not shown). Therefore, in this matter the socio-culture effect is less significant than the other factors or can be ignored. Nevertheless, research implementation revealed that there was a difference in respondent acceptance between Paleran and Arjasa, requiring more work to recruit respondents in Arjasa. Similar research findings may have resulted from surveyors exerting more effort to recruit respondents in Arjasa. The research project took a little longer to complete because of Arjasa's recruitment challenges. This also means that the program has been effective in ensuring that children's growth and development were maintained, despite the challenges posed by the pandemic. The virtual *Posyandu* program is an innovative approach to community-based health efforts that have been successful in maintaining the growth and development of CUF, even in the absence of offline *Posyandu* during the pandemic era. The program is especially important in areas where malnutrition is a major concern.

Table 3. The comparison of control and intervention group in children's growth and development parameters

***Puskesmas* working area**	**Variable**	**p-value pre-program**	**p-value post-program**
Arjasa	Weight-for-age	0.069	<0.001*
	Height-for-age	0.912	<0.001*
	Weight-for-height	0.545	<0.001*
	DPSQ	0.001*	<0.001*
Paleran	Weight-for-age	0.417	<0.001*
	Height-for-age	0.200	<0.001*
	Weight-for-height	0.842	<0.001*
	DPSQ	0.076	<0.001*

(DPSQ: Developmental Pre-Screening Questionnaire)
*Statistical analysis using the Fisher Exact Test with p-value <0.05.

According to a review article, research should explore the applications developed to support children's wellbeing during the COVID-19 pandemic[21]. This study result is relevant with the study from Prowse which stated digital technologies provide an opportunity to increase the reach of interventions and reduce costs, resources, and efforts required to produce or deliver programing[22]. Although it is also said that the effect of digital interventions on food and nutrition outcomes is still small and inconsistent. To ensure that nutrition interventions are effective, they should be designed with the target population in mind and tailored to their specific needs and preferences. Digital interventions, such as social media, can be effective in promoting healthy eating among adolescents and young adults[23]. However, it is important to evaluate the existing evidence to guide real-world decisions in real-time[22].

Nutrition education interventions can target individuals, families, social networks, and they can operate independently or in conjunction with other

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interventions such as policy, systems, and environmental change strategies. Health equity is an essential component to address historical and contemporary injustices, overcome economic, social, and other obstacles to health and healthcare, and eliminate preventable health disparities[24]. Mobile technology interventions, such as Balitagrow©, have been identified as a promising approach to address this issue by sharing information about healthy eating patterns and offering motivation for behavioral change[25]. However, evidence suggests that it is necessary to consider all the parts involved in the development of health promotion nutritional strategies to ensure positive outcomes of a virtual *Posyandu* program intervention.

Early educators contribute to children's cognitive development in their first three years by providing appropriate learning and emotional support. Early knowledge and skills inform and influence future learning, while less formal opportunities to stimulate early cognitive growth emerge naturally in children's everyday interactions with a responsive adult[26]. Early detection and intervention treatment services can improve a child's growth and development, and services for children with developmental disabilities are provided by each Public Health Center working area to evaluate and identify children who need special education services. Further study is suggested to conduct investigation of the use of technology in early detection and intervention of child's growth and development[27].

Witnessing and living through the pandemic era, an era we hope we never have to go through again, has risen awareness that growth of our children should not be limited by time and space. The research has ensured that, using the proper and adequate digital or virtual tool, our public health centers/service can monitor the continuous growth of children, without neglecting the importance of direct evaluation. The impact of the pandemic situation, where there was limited direct encounters, demanded a solution, and the research showed that the issue can be overcome by implementing innovative digital based programs/tools to evaluate and monitor child growth. This study limitation is that the model or program implementation was limited to some area or respondents and not included control group who did not use/install the app. Therefore, the result needs to be used wisely, not to be generalized under different circumstances. We suggested to implement this study in a wider community and develop the application or further refine it according to user needs.

CONCLUSIONS

We concluded that the use of technology in the virtual *Posyandu* program, including Android-based applications, has become an important tool to support children's learning and well-being during the pandemic era. Balitagrow©, the Android-based application, in the virtual *Posyandu* program has effectively maintained the children's growth and development in the pandemic era. Further research needs to be carried out to develop health promotion with Android-based applications, to refine application further based on user needs and also needs to be disseminated widely to benefit the wider community.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

ACNM: Responsible for all scientific content of the article, formulating the problem formulation, lead data collections, preparing the draft manuscript, making revisions; DAR: Make research concepts and designs, make revisions and write method chapters; IFK: Conducts supervision and guidance in the analysis and interpretation of data, and provides criticisms; YS: Analyzing and interpreting the data, input and suggestions for writing manuscripts, makes revisions in the chapter discussing the manuscript.

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