

Effectiveness of guidance on feeding rules by *Posyandu Pintar* application on eating behavior in toddlers: a quasi-experimental study

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Abstract

Collaboration is required among various stakeholders to address stunting, starting with monitoring the nutritional status of children through assistance with feeding rules. In this context, Health Service Integrated Post Cadres should enhance service delivery supported by digitalization. Therefore, this research aimed to analyze the effectiveness of guidance on feeding rules by *Posyandu Pintar* application on eating behavior in toddlers sup-

ports Forming SIGAP (*Siaga Gagal Pertumbuhan*) Villages toward a stunting-free Indonesia. The study employed a quasi-experimental with repeated treatment research design. The subjects in this study were toddlers aged 6-72 months in Karangasem Regency of Bali from July to September 2024. The number of respondents was 160 toddler, selected by Stratified Random Sampling. feeding rules mentoring were analyzed using Repeated Measures Analysis Of Variance (ANOVA). Based on the results of the ANOVA repeated measure test, showed that there was an improvement in good feeding behavior between the intervention group from the first to the fifth measurement $p \leq 0.001$, which means it is less than 0.05. This indicates that H_0 is rejected. Then it can be concluded that the guidance on feeding rules by *Posyandu Pintar* application has been proven to have an effect on toddlers eating behavior. Based on the description, this research could assist healthcare professionals, and policymakers in adapting prevention and treatment efforts for stunting.

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Introduction

The global prevalence of stunting in children was reported to be 149.2 million in 2020.¹ In this condition, children have a height lesser than the age indicating long-term malnutrition and motor impairment.² Stunting decreased to 21.6% by 2022 but 16 provinces remained below the national average.³ Therefore, different efforts must be carried out to reduce the national prevalence of the condition towards the Indonesia Emas 2045.⁴ Stunting can also lead to decreased intellectual ability, mental retardation, and chronic diseases.⁵ Although Bali is not a stunting area nationally, stunting cases have also been found in Bali Province and are important to note. In Bali Province, four out of nine districts/cities still have a below-average prevalence for children under five, with eastern Bali Karangasem Regency ranking first at 22.9%.⁶ The number of stunted children in Karangasem Regency and Kubu District was 1,467 (7% of the total population) and 284 (17.9%) from nine villages, respectively.⁷ The causes are nutritional intake, access to preventive services, and incorrect eating behavior.⁸

This lack of nutritional intake is caused by toddlers who do not want to eat, or have a poor appetite and have difficulty eating. If this is left alone by parents, the toddler's nutritional intake will not meet nutritional needs according to age. The mother's habit of waiting for toddlers to ask for food is also a factor in stunting.⁹ Toddlers tend to prefer playing so they forget to eat. The lack of variation in providing food can also result in stunting, for example, toddlers are only given a monotonous menu of food that they like without any snacks from vegetables, other proteins, and fruits.¹⁰ Inappropriate feeding patterns that are not in accordance with the age of the toddler can result in nutritional deficiencies that put the toddler at risk of infection. Nutrition plays an impor-

tant role in a child's appetite. If the eating pattern is not achieved properly during the growth and development period, it can have an impact on the child such as a thin body and stunting. Inappropriate feeding patterns and nutritional intake that does not meet the child's body needs can also hinder future development.¹¹ Parenting patterns in providing food that include providing breast milk and providing nutritious complementary foods, healthy eating habits, and implementing feeding rules can improve the nutritional status of toddlers.¹²

Interventions to prevent stunting include addressing feeding practice mistakes, anxiety about portion sizes, eating difficulties, and inappropriate feeding practices.¹³ Feeding rules include implementing regulations for meals, including times, nutrition, and eating procedures.¹⁴ Every child needs high-quality food and optimal nutrition to support growth and development, and parents should ensure appetite is not lost by implementing feeding rules.¹⁵ Research in Lhokseumawe showed a good correlation between the application of feeding rules and the nutritional status of children aged 6-24 months ($p=0.001$).¹⁶ Previous research stated that 219 (97.7%) mothers who improperly applied feeding rules had children experiencing a mouth closure disorder ($p=0.000$).¹⁷ The application of Basic Feeding rules can create an accurate MP-ASI feeding behavior, which improves the nutrition and growth of children.¹⁸ Previous government efforts have conducted health counseling on stunting, anthropometric examinations, and supplementary feeding as short-term efforts.

The implementation of feeding rules requires nutritional status control, hence Health Service Integrated Post-cadres play a crucial role in ensuring reasonable control. *Posyandu* is the main frontline for maintaining the wellbeing of mothers and children.¹⁷ The prevention of stunting must be supported by digitalization to facilitate the tracing and reporting of nutritional status. Digitalization can be realized by developing an integrated *Posyandu Pintar* application for health centers and departments. The *Posyandu Pintar* assists *Posyandu* cadres in documentation and reporting. The utilization is crucial since research on «Ghosting» android-based application and «Si Jaks» has proven effective in reducing stunting.^{19,20}

Based on the description above, cooperation is required to address stunting from various stakeholders, including healthcare professionals, *Posyandu* cadres, and village officials. *Posyandu* cadres and village officials, being closest to the community, act as an extension of healthcare workers in addressing maternal and child health issues and provide strategic solutions.²¹ Intervention with village cadres and officials as stunting prevention agents needs to be carried out because there is limited knowledge and awareness of village communities, especially cadres and officials, regarding stunting prevention.²² In addition, the performance of information systems can increase the effectiveness of nutritional health in primary services that provide various kinds of information, such as history, general information on stunting, development records, data monitoring, and health services.²³ In Indonesia, health service activities through *Posyandu* are recording, recapitulating, and reporting data manually, allowing service activities to last for a long time. The *Posyandu Pintar* application containing health information, early detection of stunting, services such as vaccination, and child reporting facilitates tracing and treatment of stunted children to move towards a stunting-free country. The implementation of SIGAP (*Siaga Gagal Pertumbuhan*) Village is expected to build and empower self-reliant communities. The SIGAP Village must be thoughtfully implemented to maximize information and education on stunting issues. The members and mobilization teams focus on optimizing stunting eradication, starting from the village.

There is no previous research focused on village innovation through *Posyandu* by providing feeding rules, assistance interventions, and smart application to prove the effectiveness in reducing stunting. Interventions to handle incorrect eating behavior and application are not intended for *Posyandu* cadres in villages to conduct tracing and treatment since stunting events remain unpreventable. Based on problems such as the high incidence of children with difficulty eating, the absence of *Posyandu* digitalization, and the lack of tracing are the causes of high stunting. The priority of solving the problem is the formation of SIGAP Village Innovation (Preparedness for Growth Failure) through mentoring feeding rules, and *Posyandu Pintar* application. This innovation is also expected to improve future health conditions suitable for specific situations and targets. Therefore, this research aimed to form and obtain the effectiveness of guidance on feeding rules by *Posyandu Pintar* application on eating behavior in toddlers supports forming SIGAP Villages towards a stunting-free Indonesia in Karangasem Regency of Bali.

Materials and Methods

Research design

This research using a quasi-experimental method with repeated treatment research design to analyze effectiveness of guidance on feeding rules by *Posyandu Pintar* application on eating behavior in toddlers (Figure 1).

Population, sample and sampling

The population in this study was 2184 toddlers aged 6-72 months in Karangasem Regency, Bali Province, Indonesia. The sample size was determined using G-Power with a significance level of 0.05 and a power of 85%, yielding 146 subjects.²⁴ To avoid dropout, the sample size was increased by 10% to become 160 samples, which were then divided into two groups, namely the intervention group of 80 people and the control group of 80 people. The sampling technique was carried out using Stratified Random Sampling, with the inclusion criteria for the sample being toddlers aged 6 to 72 months without congenital abnormalities such as cleft lip, esophageal atresia, or congenital heart disease. Exclusion criteria were digestive disorders, respiratory disorders, and tuberculosis. This research was carried out in nine villages in Kubu sub-district, Karangasem Regency, Bali Province, Indonesia from July to September 2024.

Instruments

The *Posyandu Pintar* application has been developed in three steps. Step 1-The development of the *Posyandu Pintar* application to simplify, report data, as well as trace and treat stunted children includes the following activities 1.1 Reviewing the literature on *Posyandu* services, stunting, and *Posyandu Pintar* application. 1.2 This application has been consulted and declared usable by computer science experts and medical doctors who handle stunting cases in community health centers. 1.3 Revising the appearance and content of the *Posyandu Pintar* application in line with expert recommendations. Step 2- The *Posyandu Pintar* application is developed with a customized display for Android granting easy access to *Posyandu* cadres. Step 3- The application was implemented on 219 *Posyandu* cadres for three weeks. In week 1, a pretest was conducted about *Posyandu* services were provided without an application and the procedures for using *Posyandu Pintar* was also explained. The *Posyandu* cadres use *Posyandu Pintar* application

for health services in week 2. Meanwhile, post-test measurements of health services were carried out in week 3.

This *Posyandu Pintar* application contains features for information on service participants, early detection of growth, namely the results of measuring weight and height, toddler health reports, health services that have been obtained during the implementation of the posyandu, and health information about eating behavior.

Literature studies have been conducted to develop the instruments in this study. The instruments that have been developed have been tested for validity and reliability with the results of the validity and reliability tests carried out using SPSS at a significance level of $\alpha = 5\%$ (r table for alpha 5% and $df = 30$ is 0.361). The reliability test shows data processing at a significance level of $\alpha = 5\%$ (Cronbach's alpha $\alpha = 0.908 > 0.06$; reliable). The instrument consists of three parts. Part 1 contains questions about the characteristics of age, gender, weight, height, BMI, maternal age, number of children, religion, education, occupation, family income, and health history. Part 2 contains feeding rules. Part 3 contains questions about eating behavior.¹⁷

Data collection

The stages of collection in this study were carried out in several stages, namely pretest, implementation, and posttest. The pre-test measurement assessed eating behavior before treatment. Participants subjected to the pre-test stage were given the intervention of mentoring feeding rules for one day, accompanying children during meal schedules in the first week. The implementation in this study was to provide Feeding Rules Assistance by *posyandu pintar* application for children aged 6-72 months which was carried out for one month. The intervention provided was mentoring feeding rules four times with a one-week interval from one treatment to another. Each treatment comprised mentoring the feeding rules at the meal schedule of morning, afternoon, and evening for 30 min. The outcome variable measurement was performed five times (pre-test, post-test 1, 2, 3, and, 4). The research data were collected by 219 posyandu cadres in Karangasem Regency, Bali Province, Indonesia with duration of being a Posyandu cadre is 4-7 years. The first post-test measurement was performed on the last day of the first week. The subjects were given the intervention of mentoring feeding rules in the second, third, fourth weeks, followed by post-test 2, 3, and 4 measurements on the last day. A total

of five measurements were conducted on each subject during the research. Meanwhile, the intervention for control group was provide Feeding Rules Assistance by Posyandu cadres using leaflets about feeding rules for children aged 6-72 months which was carried out for one month.

Data analysis

Data were analyzed using IBM SPSS Statistics 26 software. The characteristics of the subjects are presented as frequency (n) and percentage (%), but for eating behavior variables before and after the intervention, are presented with mean and standard deviation. To determine the level of significance, this research used an α of 0.05, with a confidence level of 95%. In this study, eating behavior was summarized and presented as numerical data. The analysis was carried out using Repeated Measures Analysis Of Variance (ANOVA) to prove the effectiveness of mentoring feeding rules over time. There are three prerequisites that are carried out before testing the hypothesis, namely the normality test, the homogeneity test and the sphericity test. This study, the normality test uses the skewness value, the homogeneity test uses the Levene test. While the sphericity test uses the Greenhouse-Geyser test.

Ethical clearance

Confidentiality and integrity were ensured to protect the privacy of participants and comply with ethical standards. Furthermore, consent was obtained from the subjects in line with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Commission of the Institute of Technology and Health Bali on June 7, 2024. 04.0268/KEPITEKES-BALI/VI/2024.

Results

Table 1 shows that the 160 subjects were divided into the control and intervention groups. In the control group, the majority were aged 6-11 months (16.9%), females (32.5%), and first-time children (16.9%). Most participants were mothers aged 20-35 years (38.1%), Hindu (48.1%), with the last education level of Junior High School (19.4%), housewives (35.6%), and income < Rp. 750,000 (38.1%). In the Intervention group, the majority were

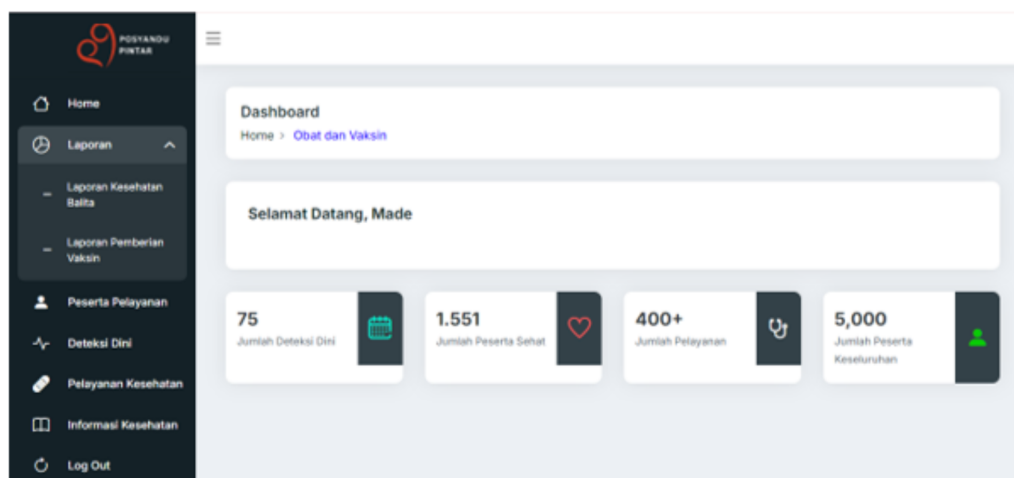


Figure 1. *Posyandu Pintar* application.

aged 6-11 months (21.3%) ($p=0.348$), females (31.9%) ($p=0.105$), and first-time children (18.1%) ($p=0.338$). Most participants were mothers aged 20-35 years (36.3%) ($p=0.607$), Hindu (48.1%) ($p=0.241$), with the last education level of Senior High School (18.8%) ($p=0.635$), as housewives (31.3%) ($p=0.058$). The majority of the income was < IDR 750,000 (33.2%) ($p=0.253$). The results of the equality test show that all respondents characteristics have a $p > 0.05$, which indicates that the characteristics of respondents in the intervention group and control group are homogeneous or equal. As presented in Table 1.

Table 2 shows the mean score of eating behavior during the pretest in the control group of 6.25, slightly increasing in posttest 1 to 6.71, slightly increasing in posttest 2 to 8.08, slightly increasing in posttest 3 to 9.41, but becoming 9.31 in posttest 4. Meanwhile, in the intervention group, the mean score of eating behavior continued to experience a significant increase, at pretest

of 6.49 which increased to 7.51 at posttest 1, increased at posttest 2 to 9.06, increased at posttest 3 to 10.08, and increased at posttest 4 to 10.41.

Normality and homogeneity of variance test results

Testing data normality and homogeneity were the two prerequisites met before conducting statistical tests. The normality test using skewness values compared to the standard error indicated normally distributed data. During the pre-test, post-test stage 1, post-test stage 2, post-test stage 3, and post-test stage 4, the control and intervention groups had a value of (0.345 and -0.665), (1.282 and -0.475), (-0.211 and -1.133), (-0.252 and -0.672), and (-0.516 and 0.048), respectively. The homogeneity of variance test results using the Levene Statistic Value showed a p of >0.05 . Therefore, the eating behavior data is homogeneous.

Table 1. Subject's characteristics on feeding rules research (n=160).

Variable	Control (n=80) n (%)	Intervention (n=80) n (%)	Equal test
Age (month)			
6-11	27 (16.9)	34 (21.3)	0.348
12-23	23 (14.4)	24 (15.0)	
24-35	12 (7.5)	10 (6.3)	
36-47	8 (5.0)	5 (3.1)	
48-59 month	4 (2.5)	3 (1.9)	
60-72 month	6 (3.8)	4 (2.5)	
Gender			
Male	28 (17.5)	29 (18.1)	0.105
Female	52 (32.5)	51 (31.9)	
Born			
1	27 (16.9)	29 (18.1)	0.338
2	26 (16.3)	23 (14.4)	
3	21 (13.1)	16 (10.0)	
4	6 (3.8)	8 (5.0)	
5	0 (0.0)	4 (2.5)	
Mother's age (years)			
<20	14 (8.8)	10 (6.3)	0.607
20-35	61 (38.1)	58 (36.3)	
>35	5 (3.1)	12 (7.5)	
Religion			
Hinduism	77 (48.1)	77 (48.1)	0.241
Catholic	1 (0.6)	1 (0.6)	
Muslim	2 (1.3)	2 (1.3)	
Mother's education			
Not attend any school	0 (0.0)	4 (2.5)	0.635
Elementary school	8 (5.0)	12 (7.5)	
Junior high school	31 (19.4)	21 (13.1)	
Senior high school	30 (18.8)	30 (18.8)	
Diploma	8 (5.0)	8 (5.0)	
University	3 (1.9)	5 (3.1)	
Mother's occupation			
Housewife	57 (35.6)	50 (31.3)	0.058
Trader	4 (2.5)	0 (0.0)	
Farmer	4 (2.5)	0 (0.0)	
Entrepreneur	12 (7.5)	26 (16.3)	
Civil servant	3 (1.9)	4 (2.5)	
Families' income			
< IDR 750.000	61 (38.1)	53 (33.2)	0.253
IDR 1.000.000-3.000.000	16 (10.0)	25 (15.6)	
IDR 3.000.000-5.000.000	3 (1.9)	2 (1.3)	

Sphericity test results

SPSS produces a test known as the Mauchly test for the sphericity assumption. The results of the Mauchly test in this study showed a significance value of <0.001 ($p<0.05$), with the assumption of sphericity not being met so that conclusions were drawn using Greenhouse and Geisser corrections as alternatives. The results of the hypothesis test show a significance value of <0.001 ($p<0.05$), so it can be concluded that H_a is accepted and H_0 is rejected. Table 3 provides information on the average increase in feeding behavior of toddlers for each measurement. The feeding pattern pre-test compared to post-test stage 1 showed an average increase in scores of 0.744 and the difference in the application was significant because the Sig. value of <0.001 <0.05 . Meanwhile, the feeding pattern pre-test compared to post-test stage 2 reported an average increase in the scores of 2.2 and the difference in the application was significant because the Sig. value was <0.001 <0.05 . The pre-test compared to post-test stage 3 also suggested an average increase in scores of 3.375, and the difference in the application was significant because the Sig. value was <0.001 <0.05 .

The feeding behavior pre-test compared to post-test stage 4, post-test stage 1 compared to post-test stage 2, post-test stage 1 compared to post-test stage 3, and post-test stage 1 compared to

post-test stage 4 showed an average increase in scores of 3.494, 1.456, 2.631, and 2.750, respectively. The difference in the application was significant because the Sig. value was <0.001 <0.05 . Furthermore, the feeding pattern post-test stage 2 compared to post-test stage 3, post-test stage 2 compared to post-test stage 4, and stage 3 compared to post-test stage 4 showed an average increase in scores of 1.175, 1.294, and 0.119, respectively. Figure 2 reports the average sharpness of the increase in good feeding behavior between the intervention groups from the first to the fifth measurement.

Discussion

The first stage of the research on feeding rules involves mothers, with the majority aged 20-35 years, who are categorized as fertile. Young mothers tend not to understand the correct feeding practices for toddlers fully. Parental education is one of the factors influencing a mother's behavior toward her child, indicating that good attitudes can arise when someone has good knowledge. Maternal knowledge related to nutrition and feeding behavior is the ability and skill of mothers to understand and act on matters related to nutritious food and feeding rules crucial for a child's

Table 2. Mean eating behavior in both groups.

	Control Group		Intervention Group	
	Mean	Std. Deviation	Mean	Std. Deviation
Pretest	6.25	1.886	6.49	1.842
Posttest stage 1	6.71	2.051	7.51	2.193
Posttest stage 2	8.08	2.401	9.06	2.252
Posttest stage 3	9.41	2.067	10.08	1.986
Posttest stage 4	9.31	1.940	10.41	1.429

Table 3. Pairwise comparisons test on the improvement of feeding patterns at each measurement over time.

Time (I)	Time (J)	Mean Difference (I-J) (95% CI)
Pretest	Posttest stage 1	-0.744* (-1.115, -.0373)
	Posttest stage 2	-2.200* (-2.801, -1.599)
	Posttest stage 3	-3.375* (-3.951, -2.799)
	Posttest stage 4	-3.494* (-4.031, -2.957)
Posttest stage 1	Pretest	0.744* (0.373, 1.115)
	Posttest stage 2	-1.456* (-2.031, -0.882)
	Posttest stage 3	-2.631* (-3.248, -2.014)
	Posttest stage 4	-2.750* (-3.334, -2.166)
Posttest Stage 2	Pretest	2.200* (1.599, 2.801)
	Posttest stage 1	1.456 (0.882, 2.031)
	Posttest stage 3	-1.175* (-1.648, -0.702)
	Posttest stage 4	-1.294* (-1.766, -0.822)
Posttest Stage 3	Pretest	3.375* (2.799, 3.951)
	Posttest stage 1	2.631* (2.014, 3.248)
	Posttest stage 2	1.175* (0.702, 1.648)
	Posttest stage 4	-0.119* (-0.274, 0.036)
Posttest Stage 4	Pretest	3.494* (2.957, 4.031)
	Posttest stage 1	2.750* (2.166, 3.334)
	Posttest stage 2	1.294* (0.822, 1.766)
	Posttest stage 3	0.119* (-0.036, 0.274)

* $p<0.001$.

growth.²⁵

The majority of mothers in this study have a Senior High School education. Education plays a significant role in the success of the feeding rules program as an effort to prevent stunting problems. This is evidenced by the success of feeding rules in this study. The level of education influences knowledge, where the better the education someone has, the easier it is to receive and understand the information obtained.²⁶ Feeding rules mentoring involves implementing meal rules; hence, children can consume food regularly with good nutrient absorption. In this study, the majority of mothers are housewives. Non-working mothers have more time to manage their child's feeding patterns and ensure their child's nutritional intake.²⁷

Feeding rules mentoring includes the implementation of meal rules, enabling children to consume food regularly with good nutrient absorption. Previous research stated that decision-making in nutrition provision was crucial in solving stunting.²⁸ Policy makers in health services are expected to provide educational programs on the introduction of nutritious food according to the meal schedule by paying attention to nutritional content. In line with research in Myanmar, most children under two years old experiencing stunting are in families with low income (<25 percentile / <60 dollars).²⁹

The results provided for one month showed improvement in good feeding behavior between the intervention group from the first to the fifth measurements, with a p-value of <0.001. Feeding rules mentoring has been effective in improving the behavior of toddlers. The rules consisted of three components, namely regular feeding schedule, the environment, and the feeding procedure. The regular feeding schedule showed three main meals and two snack times. In the environment, parents or caregivers are expected to create a pleasant eating atmosphere without distractions from gadgets, toys, or television. In the context of the child feeding procedure, parents or caregivers should allow the children to eat independently for no more than 30 minutes. Parents should avoid using force or intimidation when a child refuses to eat and food should be presented in a neutral manner. After 10–15 minutes of continued refusal, concluding the mealtime is recommended.³⁰ Research in Thailand showed that parenting patterns of six-month-old children such as sleep quality and feeding rules affect nutrition-

al status and development in the first year of life.³¹

Improved feeding behavior can enhance nutritional status to reduce the prevalence of stunting. Conversely, inappropriate feeding activities lead to eating disorders in children.³² Research in Thailand states that parental behavior plays a significant role in feeding practices, where parents serve as figures or examples to be imitated, influencing the eating behavior of children.³³ Ongoing socialization efforts and periodic evaluations of feeding rule implementation can shape good eating habits, meet nutritional needs, and address issues.³⁴

Posyandu is a key pillar for preventing stunting in rural areas. This pillar is essential for the search and identification of stunting cases. *Posyandu* cadres are trained volunteers to provide basic health services and are well acquainted with the conditions of the community, especially those of pregnant women and children. These individuals play a crucial role in improving community health, particularly in the early detection of stunting to prevent and reduce the condition. In this context, *Posyandu Pintar* is a digital-based application that uses mobile phones or computers. This application is adopted by cadres and the community to access *Posyandu* services. The utilization of technology in tracing, treatment, and reporting of stunting incidents is crucial for increasing the reduction in stunting prevalence. The *Posyandu Pintar* application can enhance *Posyandu* services, particularly in preventing and identifying stunting. The results show that *Posyandu* cadres feel supported by the application, and the community easily access schedules and services. The use of mobile-based digital application in reporting is a digital solution that simplifies the recording, monitoring, and reporting processes. The application supports a more structured, accurate, and fast data-management process in reporting.³⁵

Concerning the strength of the experimental research, the analysis was carried out for the first time by forming a SIGAP village providing assistance interventions, feeding rules, and the *Posyandu Pintar* application. In the context of the limitation, variables, such as the type of food given to children when feeding rules assistance interventions are carried out cannot be controlled. A larger sample can be used by controlling the type of food given to the children during the research.

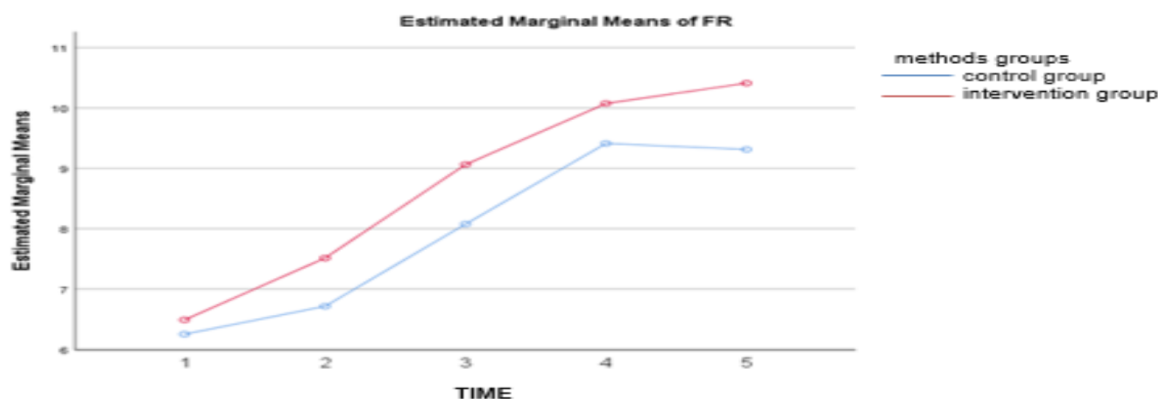


Figure 2 Plots profile of the increase in feeding behavior.

Conclusions

In conclusion, there was an increase in good feeding behavior between the intervention group from the first to the fifth measurement. Feeding rules assistance by *Posyandu Pintar* Application has been proven to have an impact on good eating behavior in toddlers in Karangasem Regency, Bali. The results were important for preventing and overcoming stunting and malnutrition in children, starting from regulating good eating behavior and establishing appropriate procedures or schedules. In addition, the *Posyandu Pintar* application for volunteers of the Health Service Integrated Service Post improved the service system. This research was expected to assist healthcare professionals and policymakers in adapting prevention and treatment efforts for relevant stunting.

Recommendations

Stunting management policies may need to be developed to analyze current child feeding issues. In addition, feeding rules assistance must be implemented to address the problem of children having difficulty eating and the presence of *Posyandu Pintar* application to improve technological progress at the basic service level.

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