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The Effectiveness of Cadre Training in Interpreting Toddler Nutritional Status using Anthropometric Indicators

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Abstract

Introduction: Anthropometric knowledge is important for assessing nutritional status; however, measurement errors can affect data quality. Therefore, it is necessary to improve the capacity of the cadres to increase the accuracy of the nutritional data. This study aimed to determine the effectiveness of cadre training in improving their ability to interpret the nutritional status of toddlers using anthropometric indicators.

Methods: This study used a quantitative research methodology with a *quasi-experimental*, one-group, *pretest-posttest design*. The training methods used were equipment preparation, presentation of nutrition and anthropometry theory, discussion, demonstration, and measurement practice by trainers. The training research subjects were 39 posyandu cadres selected through purposive sampling method. Data analysis was performed using a *paired t-test*.

Results: The cadres were mostly in the age group of 31-40 years, housewives, and more than half of them were in junior high school level and below. The training model improved the cadres' knowledge in the interpretation of the anthropometric measurement results from a score of 4.79 to 6.74 after the training, with p=0.0001, indicating a significant improvement.

Conclusion: Cadre training significantly improved the ability to interpret toddlers' nutritional status based on anthropometric indicators, supporting more accurate growth monitoring and early detection of nutritional problems at the community level.

Keywords: Training, Health Cadres, Nutritional Status, anthropometric measurements, Toddlers

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Introduction

One of the persistent health issues faced by Indonesia every year is the nutritional status of toddlers. To date, the nutritional issues of toddlers have been highly important health issues at the global and national levels.[1] The World Health Organization (WHO) has recorded that stunting, wasting, and excessive weight are the three main nutritional issues affecting the quality of life of children and potential human resources in the future.

Indonesia still faces considerable challenges related to the high stunting rate in toddlers, which reflects a condition of chronic malnutrition in the long run. The Health Ministry shared the results of the Indonesian Nutritional Status Survey at the BKKBN National Working Meeting, showing that stunting rates in Indonesia decreased from 24.4% in 2021 to 21.6% in 2022.[2] The national survey, which serves as a reference for accelerating the reduction of stunting, also reported a decrease in the national prevalence from 21.5% in 2023 to 19.8% in 2024.[3] This situation indicates that improving children's nutritional status requires more targeted and effective interventions, including strengthening child growth monitoring systems at the community level. Efforts to improve nutritional status for the development of quality human resources begin as early as possible through the first 1000 days of life, starting from the fetal stage until the age of 2 years.[4] This is because the first thousand days are a golden period of rapid brain growth and development. [5]

Ministry of Health Decree No. 1995/MENKES/SK/XII/2010 explains that the nutritional status of “short” and “very short” refers to classifications based on the Height-for-Age Index (PB/U) and Length-for-Age Index (TB/U). These terms are consistent with the concept of stunting, which is differentiated into stunted (short) and severely stunted (very short).[6] Anthropometry is a method of measuring various dimensions of the human body.[7] These indicators are used to assess whether a child is well-nourished, malnourished, severely malnourished, short, or very short stature. To accurately interpret the results of these measurements, field workers, including posyandu cadres as the spearhead of health services at the community level, must have a good understanding of these indicators.

Monitoring and evaluating the nutritional status of toddlers is an important activity carried out at Integrated Health Service Posts (Posyandu). Posyandu plays a role in improving the nutritional status of target groups, especially toddlers. Posyandu activities are carried out by cadres whose main task is to monitor toddler nutritional status through anthropometric measurements.[8] The duties of cadres in carrying out their functions in posyandu activities so that posyandu can run optimally include being able to communicate well, being skilled in recording and reporting correctly so that they can identify all health problems experienced by the community, and having knowledge and understanding of health and nutrition.[9]

Anthropometry is a key aspect of assessing the nutritional status of both children and adults. In newborns, anthropometric measurements in the first 24 h of life are important. The most frequently used parameters in newborns are body weight, length, and head circumference.[10] The use of this anthropometric method has been the main reference for monitoring the growth of toddlers. With regular measurements, the occurring changes can be analyzed to take appropriate action to support the growth and health of toddlers. The data of the measurement results play an important role in identifying the possible nutrient issue.[11]

However, in practice, problems are still often encountered in relation to training posyandu cadres in performing anthropometric measurements and, in particular, interpreting the results.[12] Errors in measurement or interpretation can lead to misclassification of children's nutritional status; for example, children at risk of stunting may not be detected or may be misclassified, which in turn affects the quality of nutritional interventions provided.[13] In fact, cadres are people directly interacting with the community and playing a strategic role in the early detection of nutritional issues, parent education, and referral to the health facility when required. Thus, improving cadre competence through directed and measured training is important to ensure the quality of monitoring the nutritional status of toddlers in the community.

The importance of this study lies in the need to improve the accuracy and reliability of toddler nutrition monitoring by strengthening the capacity of the cadres to interpret anthropometric indicators. Given

that toddlers nutritional status has a long-term impact on physical growth and development, intelligence, and future productivity, cadre training is not only a routine activity but also an important investment in human resource development. Training personnel in anthropometric measurement and interpretation can help improve their ability to read measurement results, understand the meaning of indicator differences, and provide appropriate follow-up based on assessment results.

Some previous studies have shown that cadre training can improve cognitive and technical skills. For example, Suyatno et al.,[14] found that a hierarchical training model improved the knowledge, attitude, and capability of cadres in accurately measuring child anthropometry. The type of training used was a tiered Training of Trainers (ToT) program. In the first stage, ToT training is conducted at the district level, involving core posyandu cadres as prospective trainers. This training was facilitated by expert resource persons from the fields of public health, nutrition, and anthropometry. The training methods used were participatory and hands-on, not just lectures. The methods included pre- and *post-tests* to assess changes in the cadres' knowledge, attitudes, and practices. Delivery of theoretical material on child growth concepts, anthropometric standards, and standard operating procedures (SOPs) for measurements.

Another study by Raodhah et al.,[15] also showed that anthropometric training in Mawang Village, Gowa Regency, significantly improved cadre competence in assessing the nutrient status of toddlers. This training was held at the Nurul Huda Mosque, Mawang Village, on September 14, 21, and 28, 2024, and involved 35 Posyandu cadres from the Mawang and Bontoramba Villages. The training method was participatory. This method places cadres as active participants in the entire series of activities, from planning and implementation to evaluation. Training focuses on the delivery of theoretical material and emphasizes the direct involvement of cadres in the learning process. Nazrah and Doloksaribu[16] also showed that training excellent posyandu cadres significantly improved their knowledge, attitudes, and skills regarding balanced nutrition and anthropometric measurements. These findings showed that the training was effective in improving cadres' knowledge, but most of these studies still focused on the measurement aspects, not on the capability to interpret the anthropometric measurement results comprehensively.

Previous studies have mainly focused on improving the measurement skills of cadres, and few have examined their ability to interpret anthropometric results. This study specifically addresses this issue. Based on this, this study specifically examined the effectiveness of cadre training in interpreting the nutritional status of toddlers based on anthropometric indicators. This interpretation aspect is crucial because it is the next step after the measurement process, where the measurement results must be translated into meaningful information to determine a child's nutritional status. Furthermore, the theory of nutritional monitoring explains that the accurate interpretation of anthropometric data is the first step in an effective nutritional intervention.

Thus, training designed to improve cadre interpretation skills will strengthen the growth monitoring system and minimize the risk of misclassifying toddlers' nutritional status at the field level in the future. Therefore, this study is important for providing empirical evidence regarding the effectiveness of cadre training in improving the ability to interpret nutritional status based on anthropometric indicators, thus providing a basis for developing a capacity-building program for integrated health post (Posyandu) Cadres.

The results of this study are expected to contribute to improving the quality of public health services, support efforts to reduce stunting rates in Indonesia, and serve as a reference for policymakers in planning nutritional interventions at the community level. This study aimed to assess the effectiveness of cadre training in improving the ability to interpret the nutritional status of toddlers using anthropometric measurements. We measured the increase in cadre competency before and after training and

provided recommendations for developing training programs at integrated health posts (Posyandu) in Indonesia.

Methods

This study used a quantitative research method with a quasi-experimental design and a one-group *pre-test*-post-test design to test the effectiveness of cadre training in interpreting toddlers' nutritional status based on anthropometric indicators involving the intervention group (receiving training). The research location was the Tayan Hilir District in Sanggau Regency, West Kalimantan, and the study was conducted at the Malam CSR Center in Tanjung Bunut Village, Tayan Hilir District. The study was conducted from January to April 2025. The research sample comprised cadres of integrated health posts (Posyandu) selected by purposive sampling based on active criteria and willingness to participate in training in Pedalaman and Tanjung Bunut Villages, with a total sample of 39 cadres. The independent variable in this study was training for cadres on interpreting the nutritional status of toddlers based on anthropometric indicators, while the dependent variable was the level of knowledge and skills of the cadres in interpreting anthropometry. Potential confounding variables that could affect the results of the study included the age of the cadres, their level of education, and their length of experience as cadres; however, these were not specifically analyzed in this study. Improvements in the cadre members' understanding and skills in anthropometric measurements were identified through differences in average *pre-* and *post-test* scores. The research instrument included a questionnaire containing 10 questions to assess the level of cadre understanding of anthropometric interpretation before and after the training.

The training method used in this study began with the preparation of anthropometric materials and tools, followed by theoretical presentations through lectures and discussions on toddler nutrition concepts, anthropometric indicators, and how to interpret growth charts. This was followed by a discussion session to ensure that the participants understood the concepts presented and to provide them with an opportunity to ask questions. Next, the instructor demonstrated anthropometric measurement techniques, followed by simulations and hands-on practice by the participants to ensure that the technical skills were applied accurately. A *pre-test* was conducted before the training to assess the participants' initial knowledge and skills. A *post-test* was conducted after the training to assess improvements in the participants' abilities.

The variable analyzed in this study was the dependent variable, namely, the level of knowledge of posyandu cadres in interpreting the nutritional status of toddlers based on anthropometric indicators. This variable was measured using *pre-* and post-test scores obtained from the questionnaires before and after training. Data were analyzed using the *Shapiro-Wilk test*. The normally distributed data were analyzed using the *paired t-test*, while the abnormally distributed data were further analyzed using the Wilcoxon Test.The *paired t-test* was used to analyze *pre-test* and *post-test* data to compare the average of two groups of data that were related to each other, the *pre-test* and *post-test* scores from the same respondents.

A paired t-test was used in this community service activity to measure the difference in the level of knowledge of Posyandu cadres regarding anthropometric indicators before and after training. The *paired t-test* analysis produced a t-value and a p-value, which is the level of significance. The significance level used in this study was set at $\alpha = 0.05$. A p-value < 0.05 was interpreted as a significant difference between the *pre-* and *post-test* scores, indicating that the training was effective in improving the knowledge of the posyandu cadres.

Results

Table 1 shows that the posyandu cadres who participated in the survey were predominantly of productive age, with secondary education being the most common. Most respondents were housewives, indicating that they had relatively flexible schedules to perform their duties as cadres. In terms of experience,

the majority of the cadres had relatively short periods of service, although there was also a proportion of cadres with long-term experience. This condition shows that there are variations in the characteristics of the respondents, both in terms of age, education, occupation, and length of service as cadres, which have the potential to affect their initial capacity and acceptance of the training provided.

Table 2 shows an increase in the cadres' abilities after they participated in the training. Most post-test items showed an increase in the percentage of correct answers compared to the *pre-test*, especially questions regarding the function of growth charts, BB/U indicators, and the importance of age accuracy in interpreting PB/U and TB/U. Several items showed significant improvement, particularly in terms of determining nutritional status on the PB/U –3 Z-score indicator, where previously, no participants gave the correct answer, but this increased to 51.3% in the *post-test*. However, understanding of the Z-score concept, including the meaning of a Z-score of 0 and the BB/U category above +2, remained relatively low despite improvements in the post-test.

Based on Table 3, the results of the *paired sample t-test* show an increase in the ability of cadres after the training. The difference in scores before and after the intervention was statistically significant, indicating that the training had a real effect on improving the knowledge of cadres in interpreting the nutritional status of children based on anthropometric indicators. These findings indicate that the training provided is effective in increasing the capacity of posyandu cadres, particularly in understanding and interpreting anthropometric measurement results.

Table 1 Frequency Distribution of Characteristics of Posyandu Cadres in Tanjung Bunut Village and Pedalaman Village

Characteristics	Frequency (n)	%
Age		
20 – 30 years	9	23.1
31 – 40 years	17	43.6
41 – 54 years	13	33.3
Education		
Elementary School	12	30.8
Junior High School	9	23.1
Senior High School	18	46.2
Occupation Besides Cadre		
Housewife	30	76.9
Farmer	4	10.3
Secretary of Village Consultative Body in Tanjung Bunut	1	2.6
Seller	2	5.1
Quranic teacher	1	2.6
Teacher	1	2.6
Period to be Cadre		
0 – 5	17	43.6
6 – 10	9	23.1
> 10	13	33.3
Total	39	100

Table 2 Frequency Distribution of Posyandu Cadre Training in Anthropometric Interpretation Before and After Training

Question		Correct		Wrong	
		F	%	F	%
The main function of toddler growth charts.	*Pre-test*	28	71.8	11	28.2
	Post-test	36	92.3	3	7.7
The meaning of the *Z-score* 0 line on the growth chart.	*Pre-test*	10	25.6	29	74.4
	Post-test	18	46.2	21	53.8
Question		Correct	Wrong	Correct	Wrong
		F	%	F	%
The nutritional status of an 8-month-old child with a height of 64 cm and based on the indicator (PB/U) is below -3 Z-score.	*Pre-test*	-	-	39	100.0
	Post-test	20	51.3	19	48.7
The BB/U indicator is used to assess nutritional status using.	*Pre-test*	29	74.4	10	25.6
	Post-test	35	89.7	4	10.3
The purpose of recording on growth charts.	*Pre-test*	28	71.8	11	28.2
	Post-test	30	76.9	9	23.1
The interpreting of the child's weight is between Z-scores of -2 and -3 on the weight-for-age chart.	*Pre-test*	16	41.0	23	59.0
	Post-test	17	43.6	22	56.4
The interpreting of TB/U and PB/U must take into account the child's age.	*Pre-test*	23	59.0	16	41.0
	Post-test	35	89.7	4	10.3
Category of children if the point on the BB/U graph is above +2 Z-score.	*Pre-test*	4	10.3	35	89.7
	Post-test	12	30.8	27	69.2
Growth indicators used in the WHO-2006 chart.	*Pre-test*	19	48.7	20	51.3
	Post-test	25	64.1	14	35.9
The first step before interpreting the BB/U measurement results for boys.	*Pre-test*	30	76.9	9	23.1
	Post-test	35	89.7	4	10.3

Table 3 *Pre-test* and *post-test* scores of Cadre Knowledge

Cadre Knowledge	*Mean*	*Standard Deviasi*	*Standard Error Mean*	*p-value*
Pre-test	4.79	1.704	0.273	≤0.000
Post-Test	6.74	2.009	0.322	

Discussion

The results of the *paired sample t-test* indicated a significant increase in the ability of cadres to interpret the nutritional status of toddlers based on anthropometric indicators after training, with the results showing a statistically significant difference in *pre-* and *post-test scores*, which indicates the effectiveness of the intervention in detecting knowledge of anthropometric tools. The main advantage of this activity lies in the implementation of a comprehensive training method, which includes the delivery of theory and direct application of anthropometric measurements. Posyandu cadres can gain a deep understanding of accurate measurement techniques and avoid errors by practicing directly using equipment such as microtoices and weighing scales. Overall, the training was effective in increasing the knowledge level of cadres, but the material related to Z-score interpretation still requires further reinforcement.

The improvement in the cadres' abilities in this study is thought to have occurred because the training method used was comprehensive, combining theoretical and practical approaches to training. The training not only provided conceptual understanding through lectures and discussions but also included demonstrations and hands-on measurement and interpretation practices using standard anthropometric tools.

This approach is in line with adult learning theory, which emphasizes that the

learning process is more effective if participants are actively involved and gain direct experience. Hands-on practice allows cadres to understand the real context in the field, minimizes misinterpretation, and increases their confidence in assessing the nutritional status of toddlers.

Previous research indicates that similar training can improve the knowledge and skills of cadres in interpreting anthropometric data. This research/community service was conducted in Parit Mayor Village, East Pontianak District, Pontianak City, West Kalimantan in 2022. The methods used were counseling and training on nutritional status monitoring through lectures, discussions, and demonstrations of anthropometric measurements, with a one-group pretest–post-test design evaluation. This method has proven effective in improving cadre knowledge.[17] This study was conducted in RW 08, Cibeber Village, Cimahi City, West Java, in 2025. This quantitative research used a one-group pre-test-post-test design with anthropometry training integrated with the BERAKSI application to improve the knowledge of posyandu cadres in the early detection of child stunting. For example, the use of the "BERAKSI" application was able to increase cadres' knowledge from 56% to 100% in the good category.[18] Arianto's[19] research was conducted in Nyalindung District, Sukabumi Regency, on toddler health center cadres during May–July 2022 with a one-group pretest–posttest pre-experimental design. The intervention consisted of theoretical and practical training in anthropometry and KMS completion for 58 cadres selected through purposive sampling. The study also reported a significant increase in skills ($p = 0.000$), although nutritional knowledge did not show a significant change ($p = 0.057$).

These findings indicate that increasing the capacity of cadres through training directly impacts the quality of toddler nutritional status data collected in the field. Accurate data and precise interpretation enable more rapid and effective nutritional interventions while simultaneously strengthening the child growth and development monitoring system at the community level. Thus, cadre training plays a crucial role in supporting the national stunting reduction program. However, the effectiveness of training is determined not only by its duration and content but also by follow-up in the form of mentoring, regular supervision, and the provision of standardized anthropometric measurement tools. A more effective training model is tiered training or training with mentoring, the use of interactive learning media, and technology, such as digital applications, to aid interpretation. This type of training not only improves cadres' technical skills but also strengthens their analytical abilities in accurately interpreting anthropometric results

Although most studies have shown positive results, some have reported different results. Research in Nyalindung District, for example, showed an increase in skills but no significant improvement in nutritional knowledge.[19] Another study conducted in Kedaung, Depok City in 2023 used a pre-test–post-test quasi-experimental intervention design to assess the knowledge, precision, and accuracy of anthropometric measurements taken by female Posyandu cadres. However, an evaluation of cadres in Depok found that although knowledge increased, measurement accuracy remained low despite high precision.[20] The difference in these results was caused by the variation in training quality, the difference in the educational background of the cadres, and the lack of post-training follow-up in Depok.

Research on the effectiveness of cadre training also has several limitations, including pre-experimental designs without a control group, which cannot fully prove cause-and-effect relationships, small sample sizes, and short training periods. Furthermore, some studies only assessed improvements in cadre knowledge and skills without examining the direct impact on changes in toddlers' nutrition. External factors, such as socioeconomic conditions, sanitation, and family nutritional intake, can also influence intervention outcomes. Therefore, further research with experimental designs, larger sample sizes, and long-term follow-ups is needed to ensure the sustainability of training effects.

Conclusion

The training significantly improved the ability of the cadres to interpret toddlers' nutritional status based on anthropometric indicators ($p < 0.05$). This finding indicates that the training was effective in strengthening the cadre's understanding and ability to interpret anthropometric indicators to assess the nutritional status of toddlers. To ensure sustained improvements in data quality and early detection of nutritional problems, cadre training should be supported by integrated government policies and continuous mentoring of routine health services.

Ethics approval

This study was approved by the Health Research Ethics Committee of the Faculty of Health Sciences and Psychology at Muhammadiyah University of Pontianak. Written informed consent was obtained from all participants.

Availability of data and materials

All data generated or analyzed during this study are included in this article.

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Author Contribution

HAF is the main researcher with contributions to writing, data collection, analysis and processing. IB and IS were lecturer supervisors who directed and provided input for any errors and writing in the present study. M and WP were the research team members who assisted with data collection and analysis.

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