Original Article

Implementation of Android platform application "PSG Balita" ISO/IEC 25010 standardized to improve nutritional status data for toddler

Agus Hendra Al Rahmad[1,2*], Ichsan[1], Ratna Wilis[3]

[1]Department of Nutrition, Health Polytechnic of Aceh, Ministry of Health, Aceh, Indonesia
[2]Doctoral Program in Medical Science, Faculty of Medicine, Universitas Syiah Kuala, Aceh, Indonesia
[3]Department of Dental Health, Health Polytechnic of Aceh, Ministry of Health, Aceh, Indonesia

(Correspondence author's E-mail: 4605.ah@gmail.com, 085260047644)

ABSTRACT

The need to obtain data and information on nutritional status based on the name by address is required for nutrition reporting. Thus, we should use technological advances to support the quality of toddler nutritional status data. The "PSG Balita" application has ISO/IEC 25010 standards and allows proper recording. This study aimed to measure the effect of implementing an Android-based "PSG Balita" application with ISO/IEC 25010 standards on the quality of toddler nutritional status data. A quasi-experimental research design was conducted in Banda Aceh City in 2021, involving 30 nutritionists at a health center. Data were collected through interviews and observations using a questionnaire that included timeliness, completeness, accuracy, and usefulness. The intervention was conducted through training using the Android-based "PSG Balita" application for one month. Data analysis using the Repeated Measures ANOVA test. Results, the "PSG Balita" application has shown a significant effect in improving the quality of nutritional status data for children under five (p < 0.05). It was found that after implementing the application for one month, the aspects of timeliness (p= 0.000), completeness (p= 0.000), accuracy (p= 0.001), and usefulness (p= 0.002) could improve the quality of nutritional status data for toddlers. In conclusion, the "PSG Balita" application has made it easier for users to monitor the nutritional status of a toddler, has good accuracy, and allows early identification of the risk of malnutrition. The "PSG Balita" application, which adheres to ISO/IEC 25010 standards, can enhance the accuracy of nutritional status data for young children.

Keywords: ISO/IEC 25010, Nutrition Status, PSG Balita, Data Quality

INTRODUCTION

Nutrition is an important factor in children's growth and development, and malnutrition can adversely affect children's health and lives[1]. Globally, the problem of nutritional status in toddlers is a very serious issue to be addressed, especially in developing countries such as Indonesia[2]. Data from the World Health Organization (WHO) show that by 2020, approximately 149 million children under five will be stunted or chronically malnourished. Indonesia has one of the highest stunting rates worldwide[3].

Based on Riskesdas (Basic Health Research) data in 2018, Indonesia showed that the prevalence of stunting in children under five was 30.8%, malnutrition or wasting reached 10.2%, and underweight by 17.7% and overweight by 8.0%[4]. Likewise, the Indonesian Nutrition Status Survey (INSS) data report shows that in 2022, the prevalence of stunting was 21.6% (a decrease of 2.8% from 2021), wasting was 7.7% (an increase of 0.6% from 2021), underweight was 17.1% (0.1% from 2021), and overweight was 3.5% (decreased 0.3% from 2021)[5]. Meanwhile, in Aceh Province in 2022, nutritional problems have not

significantly improved. The problem of stunting was very serious (31.2%), and the fifth province had the highest prevalence in Indonesia. Likewise, the prevalence of wasting was 11.3%, underweight was 24.3%, while the prevalence of overweight was only 1.9%[5].

Based on these three nutrition problems, Aceh Province is still struggling to break out of the top five provinces with the highest prevalence of malnutrition in Indonesia. Malnutrition in Aceh Province has become a concern for the central government, local governments, and the community. Several efforts have been made to address this problem, but they have not shown significant results

One of these efforts is to utilize information and communication technology (ICT) in the health sector. The use of ICT is expected to improve the quality of health services and facilitate public access to accurate and reliable health information[6]. One example of using ICT in the health sector is an Android platform application for monitoring growth and development and assessing nutritional status[7,8,9].

However, despite these efforts, undernutrition remains an unresolved problem in Indonesia. Therefore, more in-depth research is needed to evaluate the effectiveness of the "PSG Balita" application in improving the quality of the under-five nutritional status data.

Several studies have addressed the impact of ICT-based health applications on healthcare quality. Using health apps can improve the efficiency and quality of healthcare services. However, in another study conducted no studies have specifically evaluated the impact of implementing ISO/IEC 25010-standardized apps on the quality of under-five nutritional status data. However, no study has specifically evaluated the impact of implementing ISO/IEC 25010-standardized apps on under-five nutritional status data quality[10,11].

In previous research, an Android-based application has been developed, namely "PSG Balita." It can assist nutritionists at the health center in facilitating data reporting, especially data on the nutritional status of toddlers on indicators of WHZ, HAZ, WAZ, and BAZ[9]. The application meets the ISO/IEC 25010 standard quality test, which shows that the "PSG Balita" application is functionally capable of responding to the needs of power (82.5%) and nutrition experts based on the

value of functional appropriateness, accuracy, suitability, and reliability provide a score of 78.0%[12].

Furthermore, this application aims to make it easier for nutritionists and policymakers to monitor nutrition problems in their respective areas so that decision-making is right on the target. Therefore, referring to the problems described above, this study aimed to measure the effect of the Android-based "PSG Balita" application with ISO/IEC 25010 standards on the quality of nutritional status data for toddlers in Banda Aceh City.

METHOD

This study used a quasi-experimental design with a pretest-posttest design approach, which measures variables in the same group before and after treatment. The research was conducted in Banda Aceh City, Aceh Province, for five months, from June to October 2021.

The sample consisted of Nutrition Executives in the working area of the Banda Aceh City Health Office. The sample size was calculated using the following equation to test a two-sided hypothesis in a population of averages[13]:

$$n = \frac{\sigma^2 (Z_{1-\alpha/2} + Z_{1-\beta})^2}{(\mu_o - \mu_a)^2}$$

The sample size obtained from the calculation of the above equation included 30 nutrition workers. Purposive sampling was used, with the inclusion criteria being a minimum education of Associate's degree in nutrition (D3-Nutrition), as a nutrition manager both at the Health Center and at the Health Office, and willingness to be actively involved until the research was completed.

The "PSG Balita" application was developed using a waterfall model approach. The prototype model stages include system requirements, application design and implementation, and application evaluation. The application has undergone expert testing (78.0), and the user needs testing (82.5). Based on the assessment results, it is concluded that the application is based on ISO/IEC 25010 standards. A qualitative study was conducted so that data collection and processing used triangulation, namely comparing interview and observation data, to obtain data consistency, completeness, and certainty.

A quantitative approach is necessary for this study because it aims to measure the value of the quality of data on the nutritional status of children under five. The measured aspects were timeliness, completeness, accuracy, and usefulness. Data collection began with focus group discussions (FGDs) and direct interviews with subjects. The questionnaire consisted of 30 items. Questions on timeliness, completeness, accuracy, and benefits were valid and reliable. Furthermore, quantitative data processing was computerized in several stages: editing (data checking), coding, computer data entry, and cleaning.

The stages of analysis included data reduction, inference testing, data display, and conclusion drawing: plotting/validation—statistical data analysis using the application, namely R statistics. The data in this study were normally distributed (p>0.05) based on the Shapiro-Wilk test; thus, the test that can be used is Repeated-Measures ANOVA at 95% CI. This study underwent an ethical review at the Health Research Ethics Commission (KEPK) Poltekkes Kemenkes Aceh, number LB.02.03/014/2021.

RESULTS

Structure and System Model of the "*PSG Balita*" application

The "*PSG Balita*" application provides a visitor feature that can view the front page (home) and try out the features in the application. However, if visitors want to use several other features such as Calculating child nutrition information at the time of the visit (*Anthropometric Calculator*), analyzing *Nutritional Status Survey* data and monitoring toddler growth (*Individual Assessment*), creating a profile. However, the user can no longer register (*Create an Account*) in this updated version. It aims to facilitate and have widespread access to the application.

Process data on the "*PSG Balita*" application using the PHP language integrated into the MySql database[14]. This scheme is called an Entity Relationship Diagram (ERD) design. An entity relationship diagram or ERD is a model that describes the relationship between data in a database based on basic data objects with relationships between each entity. ERD models the structure of data and the relationships between data, using various symbols and notations to describe the

relationships between entities[15].

Next, the algorithm design process uses PHP to help the system computation or problem-solving. In algorithmic programming, the activity is often considered as determining the program logic that will be made depending on the database conditions[16]. There are two important algorithms, namely the formula for calculating the nutritional status of toddlers (for all indicators) using the LMS method, and the second is the reference standard used by WHO in determining nutritional status, with the equation LMS[17]. Children's nutritional status was assessed based on each toddler's weight and height data converted into standardized values (Z-score) using the WHO-2005 anthropometric scale[17]. The LMS method, a reference standard used by the WHO to determine nutritional status, is used to calculate the nutritional status of toddlers (for all indicators) with the following equation.[18]

$$ Z_{ind} = \frac{\left[y/M(t) \right]^{L(t)} - 1}{S(t).L(t)} $$

Wheres:

Z_{ind} : Represents the Z-score value for each indicator, namely WAZ; HAZ; WHZ; BAZ; MUACAZ and HCAZ

y : Measurements of weight (kg); height (cm); BMI (kg/m^2)

$M(t)$: Absolute median value at the WHO growth standard reference for age or height or BMI

$S(t)$: Absolute sigma value at the WHO growth standard reference for age or height or BMI

$L(t)$: Absolute lambda value at the WHO growth standard reference for age or height or BMI

The Minister of Health Regulation Number: 2 of 2020 concerning Child Anthropometric Standards are referenced in the categories and thresholds resulting from the system process in the "*PSG Balita*" application. In evaluating the nutritional status, new categories and thresholds have been added to the MGRS study formulation[19].

Menu View of "*PSG Balita*" Application

The *Anthropometric Calculator* and *Individual Assessment* modules are displayed on the application's first screen. According to nutrition experts, the "*PSG Balita*" application was created using scientific methods and following the laws that govern the monitoring of nutritional status in

Indonesia. This information can be provided in the "*PSG Balita*" application's initial appearance.

In addition, the interface on the *Calculator* menu includes a list of fields for measuring the anthropometry of toddlers, including *Date of Birth*, *Date of Visit*, *Sex*, *Measured Position*, *Odema*, *Weight in kilograms*, *Height in centimeters*, *Head Circumference*, *Upper Arm Circumference* as well as in centimeters (MUAC). The application uses six indicators to determine the nutritional status of toddlers after the anthropometric data has been entered accurately and completely WAZ, HAZ, WHZ, BAZ, MUACAZ, and HCAZ. The Indonesian nomenclature has been used to provide information on all indicators.
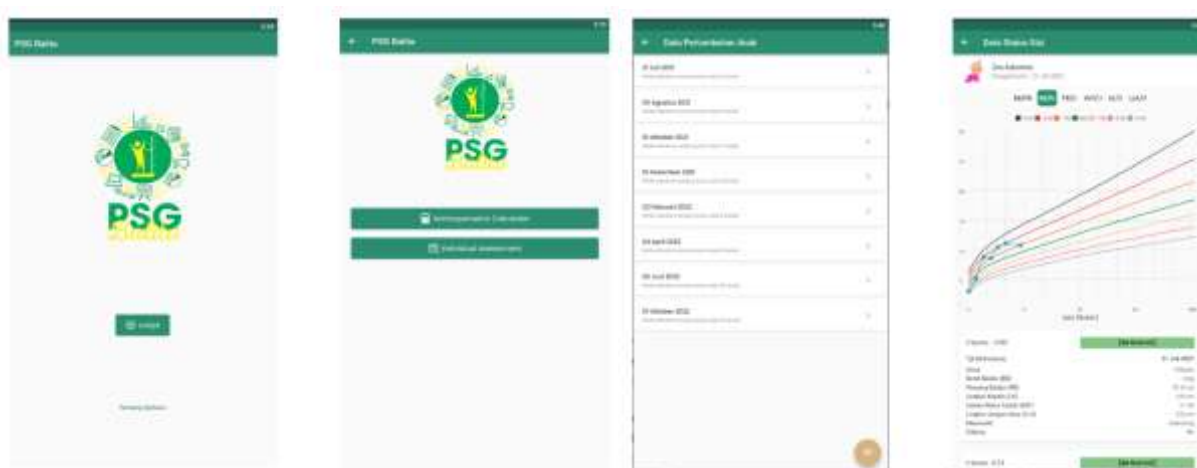
Figure 1. View of the "*PSG Balita*" App

As a result of the discussion regarding the Calculator menu feature, it was determined that the dietitian wanted the child's nutritional status to be displayed next to each indicator. As well as labeled following the Minister of Health's Regulation Number: 2 of 2020 regarding *Child Anthropometric Standards*. The expert team believes that if this information can be displayed, other users—like the general public—will find it simpler to learn about the nutritional status of their children.

The Individual Assessment module, which enables users to gather and store longitudinal data for toddlers who are repeatedly examined, is the main feature that has been updated. Anthropometric information makes up the collected data. Nutritionists can track the nutritional status and spot growth issues earlier thanks to integrating the Growth Module (*Individual Assessment*).

As mentioned, this module enables users to gather and store data longitudinally for repeatedly examined toddlers, just as toddlers visit the Integrated Healthcare (Indonesian called a Posyandu) and receive a Growth Chart (known as a KMS in Indonesia). Anthropometric information on toddlers was gathered during various visits. Data can be presented over multiple visits in this module's graphic display to show trends in children's growth. Nutritionists and parents are encouraged to track children's growth using this module.

Application of the "*PSG Balita*" and the Quality of Data on Toddler Nutrition Status

In just one month of implementation, the ISO/IEC 25010-compliant "*PSG Balita*" application has significantly improved the quality of nutrition data, particularly regarding timeliness, completeness, and accuracy.

Table 1. Effect of Implementation of the "*PSG Balita*" Application with ISO / IEC 25010 Standards on the Quality of nutritional status data for Toddlers

Implementation of the ISO/IEC 25010 Standard "*PSG Balita*" Application			
Pre - second week		3rd week - 4th week	
Δ Means $\pm$ Deviation	p-value	Δ Means $\pm$ Deviation	p-value

Timeliness	2,3 ± 5,49	0,083*	18,5 ± 8,13	0,000
Completeness	11,0 ± 5,98	0,000	22,0 ± 4,10	0,000
Accurateness	12,3 ± 7,86	0,001	7,5 ± 4,44	0,001
Usefulness	2,3 ± 3,02	0,004	6,3 ± 5,82	0,002

Wheres: Δ= Mean difference; *Not significant

The study results (Table 1) show that implementing the ISO/IEC 25010 standardized "*PSG Balita*" application positively impacts the quality of under-five nutritional status data. First, related to timeliness, there was an insignificant improvement in the second week (p= 0.082). Furthermore, in weeks 3rd to 4th, there was a significant improvement (p= 0.000), indicating that the implementation of the ISO/IEC 25010 standardized "*PSG Balita*" application succeeded in improving the adequacy of time in collecting data on the nutritional status of children under five.

Second, regarding the completeness, there was a significant improvement in week 2 (p= 0.000). This improvement continued in weeks 3rd to 4th, with the difference in mean ± deviation increasing positively (p= 0.000). Implementing the ISO/IEC 25010 standardized "*PSG Balita*" application improved the completeness of data on the nutritional status of toddlers. Third, related to the accuracy, there was also a significant improvement in week second (p = 0.001). However, there was a slight decrease in weeks 3rd to 4th, with a mean ± deviation difference of 7.5 ± 4.44 (p= 0.001). Nevertheless, implementing the ISO/IEC 25010-standardized "*PSG Balita*" Application still succeeded in significantly improving the accuracy of under-five nutritional status data.

Fourth, there was a significant improvement between the second week and benefits (p= 0.004). Implementing the ISO/IEC 25010 standardized "*PSG Balita*" application successfully increased the advantages of gathering information on the nutritional status of children under five, as evidenced by the continuation of significant improvements in weeks three and four (p = 0.002). Implementing the ISO/IEC 25010 standardized "Toddler PSG" application has positively impacted the quality of under-five nutritional status data, particularly in timeliness, completeness, accuracy, and usefulness, according to the study's findings (Table 2).

This study has demonstrated that using the ISO/IEC 25010 standardized "*PSG Balita*" application improves the timeliness, completeness, accuracy, and usefulness of data

on nutritional status in children under five. It is consistent with earlier research demonstrating how information technology can enhance the accuracy and productivity of health data collection.

DISCUSSION

Detecting growth disorders can be done with a growth chart based on the plotting results on the growth chart. However, given the rapid development of information and technology, several applications have been able to perform early detection of growth disorders[20]. Likewise, with this "*PSG Balita*" app, the module that has been integrated into the application can detect toddler growth disorders at each visit to the Posyandu[21]. Thus, growth disorders or the risk of overnutrition can be recognized early, so steps or preventive measures can be taken more quickly and appropriately before the problem becomes more severe for a toddler[22]. It can certainly be utilized more effectively by nutritionists and parents of children under five[23]. The "*PSG Balita*" application has answered nutrition problems at the community and household levels. However, this application has not been able to notify the analysis results on toddler growth[9]. Therefore, it remains a consideration to be able to update and develop it for the better.

Individual Assessment (IA) is like an electronically presented Growth Chart that can evaluate toddlers' growth and development based on age and gender. Five indicators are presented to interpret the growth and development of toddlers: WAZ, HAZ, WHZ, BAZ, MUACAZ, and HCAZ. Data storage is done on the Android smartphone memory, and this is because the application runs offline. Presentation of growth charts refers to the WHO-2005 standard.

Utilization of the "*PSG Balita*" to the Quality of Toddler Nutrition Status Data
This study's results align with previous research, which shows that information technology can improve the quality of health data[24]. In addition, other studies also show that

using information technology in the health sector can increase efficiency, accuracy, and user satisfaction[25]. Research by Lwin et al. shows that using mobile applications in health data collection can improve health workers' data quality and work efficiency[26]. Another study by Corsi et al., showed that information technology in nutrition data collection could improve data quality and reduce errors[27].

Implementing the ISO/IEC 25010 standardized "*PSG Balita*" application can also help improve the quality of under-five nutritional status data by improving data management, reducing data input errors, and accelerating data analysis and reporting. Previous research shows that using information technology in health data management can improve accuracy and speed in data processing[25]. In addition, the ISO/IEC 25010 standard is used as a reference for measuring software quality, including the "*PSG Balita*" application. This standard refers to quality criteria such as functionality, reliability, security, and ease of use. The "*PSG Balita*" application can ensure its quality meets the established standards by adopting this standard.

However, it should be noted that implementing information technology in health data management also has challenges, such as data security and privacy issues, lack of information technology skills among health workers, and high technology implementation costs[28]. In the context of health, using an ISO/IEC 25010 standardized "*PSG Balita*" application can ensure that the data collected on the nutritional status of toddlers is accurate, complete, and useful for health workers in conducting analyses and interventions. It can help improve the quality of child health services at the community level. In the context of Indonesia, improving the quality of data on the nutritional status of children under five is very important because the prevalence of malnutrition is still quite high there, such as stunting (21.6%), underweight (17.1%), and wasting (7.7%)[5].

Nutritionists at health centers must be maximized carrying out their main duties and roles in serving the community. Therefore, they need to conduct information- and technology-based training. In addition, training can aim to provide up-to-date information on nutritional status monitoring applications and increase work commitment through cognitive changes in individual nutritionists at health centers[23].

Using the ISO/IEC 25010 standardized "*PSG Balita*" application can have beneficial effects, enabling more precise and structured data collection. In addition, this application also allows users to collect information about the nutritional conditions of children under five years of age more quickly and easily, including nutritionists. Data entry errors during manual collection can also be reduced using "*PSG Balita*" due to features in the application such as data validation, easy-to-understand data display, and data entry that can be done using a cellphone camera[9].

This study was limited in terms of subjects and implementation time. The subjects consisted of only one group in the city of Banda Aceh, which should be able to represent nutritionists in Aceh Province. Furthermore, since the application was only implemented for one month, nutritionists may not use it sustainably.

CONCLUSION

After implementation by nutritionists, the "*PSG Balita*" application, which has ISO / IEC 25010 standards, has improved the quality of nutritional status data for toddlers in Banda Aceh City. Therefore, applying the "*PSG Balita*" application to nutritionists has improved the quality of nutritional status data, as measured by timeliness, completeness, accuracy, and usefulness.

Suggestions, encourage using the "*PSG Balita*" application to improve the quality of under-five nutritional status data throughout the Aceh Province. It can be done through socialization and training to nutritionists and integrated health post cadres at the village level. Strengthen monitoring and evaluation of the implementation of the under-five nutritional status monitoring program throughout Aceh Province by including data quality indicators as one of the evaluation variables. Therefore, it will help improve the accuracy and validity of the data.

the nutritionists at each Banda Aceh health center for their participation as research respondents.

CONFLICTS OF INTEREST:
I declare that I have no conflicts of interest that could affect the research results or the information I present in this study to the reader. I have no affiliations or financial relationships with organizations, companies, or individuals that could influence or manipulate the research results or the information I present. I aim to provide users with accurate, objective, and useful information without favoring any party.

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