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Screening for Malnutrition and the Effect of Education using the *STRONGkids* Application on Increasing Mother's Knowledge and Children's Eating Behaviour

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Abstract

This study aims at detecting malnutrition in children using a modified *STRONGkids* (Screening Tool Risk on Nutritional and Growth) application and increasing maternal knowledge and children's eating behaviour through the education provided with this application. The study used a quasi-experimental one-group pretest-posttest design. The sample is mothers who have toddlers aged 12 - 59 months, as many as 71 respondents in the working area of the Puskesmas Kecamatan Koja, Jakarta Utara, which were taken by using a purposive sampling technique. Data were analyzed using t dependent test, and AUC analysis using the Receiver Operating Characteristic (ROC) curve method. The results showed an increase in the average score of maternal knowledge p-value 0,000 and children's eating behaviour p-value 0.003 between before and after being given intervention using the *STRONGkids* modification application. The modified *STRONGkids* application had a sensitivity value of 83.33%, a specificity of 25.71%. The AUC value is 87.5%, which means that the accuracy level of *STRONGkids* screening is right, so the modification of the *STRONGkids* application can properly screen malnourished toddlers. The education provided through the application shows a significant effect on mother's knowledge and children's eating behaviour as a risk factor for malnutrition in children under five. This application needs to be further developed in a heterogeneous community group.

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1. Introduction

Fulfilment of nutrition in children greatly affects health status, especially in children. Fulfilling the wrong or inappropriate nutritional intake will cause health problems in children, especially malnutrition in children (Sulistyoningsih, 2011). Undernutrition is a nutritional status based on the weight index for age (BW / U) -3 SD (Standard deviation) to -2 SD. Malnutrition problems mostly occur in children less than five years old, due to a lack of nutrition in the form of calories and protein(Kemenkes, 2011).

According to data from the Food and Agriculture Organization (FAO), UNICEF, and WHO (2018), 34 million children are underweight, 12 million of whom suffer from acute malnutrition with a drastically increased risk of death. Kemenkes, (2018) data shows that the incidence of malnutrition and malnutrition has decreased from 2013 by 19.6% to 17.7%. The prevalence of malnutrition and malnutrition is 10.2%. Data from the North Jakarta Health Office in 2017, there were 194 malnutrition sufferers, spread across six sub-districts in North Jakarta. In 2018, malnutrition sufferers decreased from 194 to 34.

The nutritional status of children is influenced by various factors, namely the mother's knowledge and children's eating behaviour. Mother's knowledge about nutrition will influence food consumption behaviour. Besides, mother's knowledge also has a role in determining, controlling the portion, timing and menu of children's meals, by paying attention to the correct way of giving and the conditions for feeding it will have a good influence on the nutritional status of children.

Early detection of children's nutritional status can not only use measurements of weight and height but can be done by using a special questionnaire to measure children's nutrition, namely the use of the *STRONGkids* questionnaire. Hulst, J. M., Zwart, H., Hop, C. W., Joosten, (2010) proposed assessing the nutritional status of children using *STRONGkids*. *STRONGkids* is a screening tool used to identify the risk of malnutrition in children aged 1 month to 18 years. This is supported by research (Toukkola, J., Hilpi, J., Kolho, K. L., Salmio, 2019), *STRONGkids* is one of the validated screening methods. *STRONGkids* are considered a fast and practical nutritional screening tool, which consists of four items: the presence of a disease with a high risk of malnutrition; clinical assessment; food intake and the presence of vomiting or diarrhoea; and recent weight loss or gain.

This study is to modify the *STRONGkids* application as a tool for early detection of malnutrition status that can be used by families. Monitoring the nutritional status of children is carried out so that parents can independently detect children who are malnourished. The purpose of this study was to identify differences in maternal knowledge and to eat behaviour before and after being given education in early detection of the risk of malnutrition in children by using the modified *STRONGkids* application. In addition, the sensitivity and specificity of *STRONGkids* were identified in early detection of the risk of malnutrition in children under five.

2. Material and Method

This study used a quasi-experimental research design with a one-group pretest-posttest design. Data were analyzed using t dependent test analysis, AUC analysis using the Receiver Operating Characteristic (ROC) curve method. The analysis in this screening assesses the sensitivity, specificity, Positive Suspected Value (NDP), Negative Suspect Value (NDN), Positive Likelihood Ratio (RKP), and Negative Likelihood Ratio (RKN)(Dahlan, 2014). In this study consisted of the dependent variable and the independent variable, the dependent variable was the mother's knowledge and child eating behaviour, while the independent variable was the risk of malnutrition in children

under five. The questionnaire for maternal knowledge consists of 10 questions with correct and incorrect answers. As for the children's eating behaviour questionnaire, researchers referred to the validated CBEQ (Children's Eating Behaviour questionnaire). The questionnaire for children's eating behaviour divided into 2 forms of questions, namely positive questions and negative questions. Positive questions are never (1), rarely (2), sometimes (3), often (4), always (5). Negative questions never (5), rarely (4), sometimes (3), often (2), always (1).

Sampling using a purposive sampling technique consisting of 71 respondents, with the inclusion criteria for mothers who have children under five aged 12 - 59 months, both healthy and sick (at risk of malnutrition or poor nutrition). Regarding the COVID-19 pandemic outbreak, this research was conducted by means of a home visit to weigh mothers who have children under five. The data collection tool uses a modified *STRONGkids* application. This application is based on android to assess the nutritional status of children aged one month - 18 years. This tool consists of 4 questions, and a score classification to assess malnutrition in children, namely a score of 0 is not at risk of malnutrition, a score of 1-3 is a moderate risk of malnutrition, a score of 4-5 is at high risk of malnutrition.

3. Results and Discussion

On this section, the researchers present research results, and then, discussed them based on the research problems. The research results are presented in the form of univariate and bivariate analysis, as shown in the tables and picture as follows.

Table 1
Distribution of Characteristics of Respondents Based on Mother's Education, Family Income, and Gender of Children (n = 71)

Variable	(n)	%
Mother's Education		
Primary school	10	14,1
Junior high school	14	19,7
Senior high school	41	57,7
college	6	8,5
Total	71	100
Family Income		
< UMR[i]	47	66,2
> UMR	24	33,8
Total	71	100
Gender of Children		
Male	41	57,7
Female	30	42,3
Total	71	100

Based on the results of the analysis, people with senior high school education were 57.7%, and most of the family income was below the UMR 66.2%. Meanwhile, for children under five, based on gender-based on large children, male sex was 57.7%.

Table 2
Distribution of Average Characteristics of Respondents by Age of Mother and Toddler (n = 71)

Variable	N	Mean	Median	SD	Minimal-Maksimal	95% CI
Mother's Age	71	32,51	33,00	5,28	20 – 43	31,26 – 33,76
Toddler's Age	71	29,99	28,00	13,27	12 – 58	26,84 – 33,13

Based on the above analysis, it shows that the average age of the mother is 32.51 years, while the average age of children under five is 29.99 years.

Table 3
Distribution of Respondents at Risk and Not at Risk of Undernutrition Based on the Results of *STRONGkids* Screening (n = 71)

STRONGkids	N	%
Risk of malnutrition (moderate and high malnutrition)	56	78,9
Not at risk of malnutrition (low of malnutrition)	15	21,1
Total	71	100

Based on the analysis above, the distribution of respondents based on the results of *STRONGkids* screening on early detection of the risk of malnutrition in children under five found that the majority of respondents were at risk of malnutrition (moderate and high) as many as 56 respondents (78.9%).

Mother's Knowledge Overview

Table 4
Mean of Mother's Knowledge in Early Detection of Risk of Undernutrition Pretest and Posttest Intervention (n = 71)

Variable	Mean	SD	SE	*p-value*	n
Mother's Knowledge (*Pretest*)	48,45	25,22	2,99	0,000	71
Mother's Knowledge (*Posttest*)	69,01	17,74	2,10		71

Based on the results of the analysis above, it is known that the mean score of maternal knowledge in detecting the risk of malnutrition in children under five years after being given the

intervention has increased to 69.01 with a p-value of 0.000, so it can be concluded that there is a significant difference or influence between the knowledge of the mother before and after being given intervention with using the *STRONGkids* application modification.

Child's Eating Behaviour Overview

Table 5
Average Child's Eating Behaviour
Pretest and Posttest Intervention is given to Toddlers (n = 71)

Variabel	Mean	SD	SE	*p-value*	N
Child's Eating Behaviour (*Pretest*)	33,87	6,95	0,825	0,003	71
Child's Eating Behaviour (*Posttest*)	36,14	5,55	0,659		71

Based on the above analysis, it is known that the mean score of children's eating behaviour after being given intervention has increased to 36.14 with a p-value of 0.003, so it can be concluded that there is a significant difference or effect between children's eating behaviour before and after intervention using the *STRONGkids* modification application.

STRONGkids Analysis

Table 6
Value of Sensitivity, Specificity of *STRONGkids* Screening (n = 71)

No	Diagnostic Value	Pattern	Result
1	Sensitivity	30 / 36 * 100%	83,33 %
2	Specificity	9 / 35 * 100%	25,71 %

Based on the above analysis, the results showed that the sensitivity value of *STRONGkids* screening was 83.33%, the specificity value of *STRONGkids* screening was 25.71%.

Table 7
AUC Analysis of the Receiver Operating Characteristic (ROC) Curve Method on *STRONGkids* Screening

AUC	*P-Value*	OR 95% CI
0,875	0,000	0,759-0,991

The results of diagnostic tests using statistics show that the AUC value of *STRONGkids* screening is 0.875 (87.5%) with an OR 95% CI value of 0.759-0.991, the p-value is less than 0.05 (p-value 0.000). Statistically, the level of accuracy at the AUC value is classified as well based on the confidence interval of the hypothesis test carried out, which is to compare the AUC obtained from *STRONGkids*

as an index of the AUC value of 50%, so it can be concluded that there is a significant difference with the AUC value of 50%.

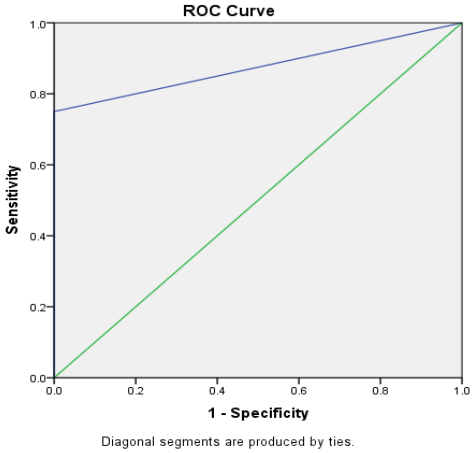


Figure 1
Receiver Operating Characteristic (ROC) Curve on *STRONGkids* Screening

Figure 1 above shows that the ROC curve that shows *STRONGkids* screening has good value because the curve moves away from the 50% line and approaches 100%.

Discussion

Mother's Knowledge

The results of the analysis show that there is a difference or influence between maternal knowledge on early detection of the risk of malnutrition in children under five before and after being given intervention using the *STRONGkids* application. According to research conducted by Wati (2018), which states that there is a relationship between the level of knowledge of mothers and the nutritional status of children under five, Mother's knowledge plays an essential role in determining food intake because a good level of knowledge will indirectly affect behaviour in choosing food which will have an impact on the nutritional intake of children under five. Good knowledge of mothers about the nutrition of children under five to eat can make it easier for mothers to take care of their children, especially paying attention to children's food intake or eating behaviour.

Child's Eating Behaviour

The results of this study indicate an increase in the mean score which is not significant between the eating behaviour of children after being given the intervention. According to research conducted by Puspasari and (Nindyna Puspasari & Merryana Andriani, 2017) which states that there is a relationship between the energy intake of children under five and the nutritional status of toddlers (BW / U).

Related to the increase in the mean score, which is not significant after being given intervention on the eating behaviour variable. Based on the results of the observation sheet, the eating behaviour of children who have nutritional problems has bad eating behaviour. Food sources that are eaten by children are not eaten regularly; they are only eaten a few times. The mother only provides food that only the child likes. In addition, related to the COVID-19 pandemic outbreak, many people have lost their jobs which have an effect on family income. Low family income has an impact on food intake in the family. In addition, mothers only provide food sources that are only liked by their children without providing other food sources in their children's food intake.

STRONGkids Screening Results

STRONGkids is a screening tool used to identify the risk of malnutrition in children aged one month to 18 years. This study was combined with *STRONGkids* undernutrition screening with anthropometric calculations (BW / U), which were then divided into two categories, namely undernutrition risk (moderate risk and high risk) and no risk of malnutrition become malnutrition status (malnutrition and malnutrition) and good nutritional status (good nutrition and over nutrition).

The results of this study have insignificant sensitivity and specificity values. The sensitivity value is quite high, while the specificity value is lower, namely 83.33% and 25.71%. This is because this research was conducted by different respondents, namely mothers who have toddlers, both healthy and sick. Whereas for weight loss in this study was very little, in previous studies weight change was caused by inadequate food intake and disease severity. In addition, in this study the observations were made by respondents who were influenced by perceptions among respondents, for example, their children were clinically thin, but respondents considered that their children were thin because they were based on heredity or were the same as the respondent when the respondent was still at the age of his child. In addition, in previous studies, observations were made by health workers, while for this study, the observations were made by respondents with various levels of education. The results of previous studies stated that for measuring *STRONGkids* with anthropometry (BW / TB) which had a sensitivity value of 71.9% and a specificity of 49.1%, while for measuring *STRONGkids* with anthropometry (TB / U) it had a sensitivity value of 69% and a specificity of 48. 4%, there is a good correlation between body weight / TB and *STRONGkids* in detecting children who experience chronic malnutrition (Huysentruyt, 2013).

The results showed that the *STRONGkids* screening curve was close to 1, which means that the screening was accurate. This is in line with research conducted by Juliana Rolim (2019), which states that *STRONGkids* can identify children who have nutritional problems. The validation of the accuracy of *STRONGkids* shows a high sensitivity value.

4. Conclusion

Based on the results and discussion of *STRONGkids* Screening, it is concluded as follows. *STRONGkids* are useful in early detection of the risk of malnutrition as seen based on the sensitivity value and optimal cutoff (ROC). The AUC value obtained is 87.5%; Statistically, the level of accuracy at the AUC value is classified as useful. The results of the analysis of maternal knowledge and children's eating behaviour showed that there was an effect of maternal knowledge before and after intervention on early detection of the risk of malnutrition in children under five by using a modified *STRONGkids* application with a p-value of 0.000 and p-value of 0.003. It is hoped that the *STRONGkids* application development can be more varied in detecting malnutrition status in children in modern times like this.

Further research is expected to be carried out in a different place by looking at the results of the KMS (weight measurement) which is routine every month so that weight gain and loss can be seen in children. In addition, based on the low specificity value, the *STRONGkids* modification application still needs to be improved and tested in heterogeneous populations, namely, children who have comorbidities, children detected with malnutrition through anthropometric measurements (TB / U, BW / TB, BMI / U). as well as children who have bad eating behaviour so that children's food intake and behaviour can be monitored continuously, which is more than one month.

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[i] Provincial minimum wage