



Analysis of Factors that affect Events and Interventions of Stunting through the E-Stunting Android Application

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Abstract

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BACKGROUND: Based on the Indonesian Toddler Nutrition Status Survey in 2021, it was found that the stunting rate in Indonesia reached 24.4%, which means that there were 5.33 million indicated stunting. A case study conducted in January 2021 in the West and South Surabaya was obtained from 59 children aged 3–5 years, there were 47 who were detected stunting.

AIM: This study aimed to detect these causative factors and the effectiveness of stunting interventions in the e-stunting application.

METHODS: The type of the research is quantitative analytic with cross-sectional approach using double linear regression analytic test with $p = 0.05$. The difference test used an unpaired sample test analytic by looking at the difference in mean in the control and treatment groups. This research was conducted in the west and south of Surabaya as well as in Sidoarjo city. The population of this study was all parents who had children aged 3–5 years who had indicated stunting. Sampling was done using totality sampling with the rule of thumb technique. This research instrument uses a minimum questionnaire of diet diversity and diet diversity as well as a questionnaire of parenting models. The entire questionnaire item went through a validity test with a product moment test where the r value of the table was greater r calculated with significance $p = 0.05$ and reliability with Cronbach alpha test results of ≥ 0.70 .

RESULTS: The results of the determinant coefficient test have a relationship between the independent and dependent variables, while adjusted $R^2 = 0.803$ which means that 80.3% of all variables affect the Z score in children, while the difference test result obtained a result of sig. two tailed with $p = 0.001$ and the value of sig. Levene's test for equality variance of $0.44 > 0.001$.

CONCLUSION: E-stunting is able to detect stunting and determine factors which influence stunting so also can move parent's behavior when they are to give handling or intervention for their child because e-stunting has a feature which easy to use anywhere and anytime. Especially, the chat feature can to access health professionals every time. This study was to find also that the stunting rate is still high, especially in suburban areas.

Introduction

Until now, nutritional problems in children have become a global problem, especially in the developing countries [1], [2]. Malnutrition is synonymous with nutritional problems related to deviations from inadequate nutritional needs such as overnutrition or malnutrition. Overnutrition or malnutrition is caused by unbalanced or inadequate nutrition, which triggers conditions of over nutrition or malnutrition. Meanwhile, malnutrition focuses on inadequate nutrition for optimal function. This condition is caused by insufficient intake, the body is not able to digest food, in a condition exposed to infection [3], [4]. Stunting is a condition of malnutrition in the long term where height/age has a Z score < 2 which is caused by unfulfilled nutrition in the first 1000 days of life [5]. Based on the WHO data in 2018, there were 149 million children suffering from

stunting and 55% of this number were in the Asian continent [3]. Based on the Indonesian Toddler Nutrition Status Survey in 2021, it was found that the stunting rate in Indonesia reached 24.4%, which means that there were 5.33 million indicated stunting [6], [7]. This number means that the prevalence of stunting has decreased, but has not yet reached the stunting reduction rate set by the Ministry of Health, which is 14% [8]. Children with stunting indications are at risk for productivity abilities in adulthood, decreased intellectuality [9], [10]. The causes of the still high prevalence of stunting include socioeconomic, cultural, parental knowledge, successful breastfeeding, and patterns of eating and feeding habits by parents [5], [11], [12].

Based on data from the Health Office of East Java Province in 2020, stunting data were 25.64%, underweight was 9.8%, and waste was 8.0%, and in 2021, the prevalence of stunting decreased to 23.5% [8]. The data explain that the nutritional problems of children

under five in East Java are still dominated by the prevalence of stunting, while in the city of Surabaya in 2021, the number of children under five with indications of stunting is 1786 children [14]. The prevalence of stunting in children under five in Surabaya decreased by 0.2% from the previous year [15], [16]. The small percentage reduction in stunting prevalence among children under five in Surabaya is closely related to the policy during the pandemic where people are allowed to visit health facilities and health workers if they experience symptoms of illness. Meanwhile, stunting does not cause serious symptoms. So that most parents assume that stunting does not affect fatal health and growth and development in the next period [17]. In addition, the high rate of stunting during the pandemic is caused by a low economic level, poor home environment, type of parental occupation, level of parental education, and family eating culture. This opinion is in line with the research of Akseer *et al.*; Gholampour *et al.*; and Vaivada *et al.* who explained that the high rate of stunting in children under 5 years of age was caused by multifactors, including the family's economic level, unavailability of clean water, family eating culture, and the accuracy of providing complementary food. From that study, it was found that stunting was influenced by the number of families living at home and abnormal hormone circulation [16], [18], [19].

There have been many studies on the factors that affect stunting in children aged 2–5 years, but the results of these studies have not had a significant impact on reducing stunting rates. Therefore, an in-depth study is needed about family eating culture, perceptions, knowledge, breastfeeding history, and complementary feeding patterns.

E-stunting is an android-based health application designed with several features related to stunting. E-stunting can be used to detect the causative factors, prevention, and treatment of stunting. This application uses the android system 4.4 (Kitkat) and program development has been carried out by using Application development Java Programming Language using Android (Software Development Kit) and (Application Programming Interfaces). The main menu in this application is the detection feature, there are several questions taken from the minimum questionnaire of diet diversity, diet diversity, and parenting models and equipped with a Z score calculation, This feature functions to detect stunting rates and identify causal factors, receipt feature to visualize the prevention, and handling of stunting according to the grade and causes of stunting and the age of the child. The type intervention contained on e-stunting application are prevention stunting likes to give exclusive breastfeeding, to complete their immunization, giving complementary food according age of child and how to serve kind of meal and so also to continue given breastmilk until 2 years old and an intervention of handling stunting likes how to process complementary food, to control health behavior and a way to prevent child from infection likes

diarrhea, worm disease, respiratory disease, and high fever while chat feature that serves to do counseling with health facilitators.

Methods

This type of research is quantitative analytic with a cross-sectional approach. The variables in this study were frequency, eating culture, perception of parenting model, and history of breastfeeding. This research was carried out in May 2021. The population is all mothers who have children aged 3–5 years who are indicated by stunting which amounts of 120 mothers, in the cities of Surabaya and Sidoarjo. Sampling uses totality sampling with the rule of thumb technique, where each variable has 10 respondents, and all of the population to be sample in this study which amounts of 120 respondents. The instruments in this study are minimum diet diversity, diet diversity, parenting models, and instruments that are arranged with closed questions with a Likert scale and have been taken validity and reliability tests. The validity test for an instruments to use product moment test with r count $> r$ table and sig = 0.05 but reliability test to use Cronbach alpha test with $p > 0.05$. All of item question in the questionnaire have been included in E-stunting on detection feature. The data are taken through the E-stunting application which has been designed for stunting early detection and stunting intervention. The analysis used multivariate multiple linear regression with R^2 and $p < 0.05$, while to determine changes in intervention behavior, pair t-test was used.

Results

Characteristics of respondents

Respondent in this study has been taken through e-stunting and come from health center in every district. The respondent has inclusion criteria among others are parents who has toddler on 3–5 ages, has one of symptoms of stunting on the previous month and so has nutrition disorder on examination last month.

Table 1 describes that most of the respondents have education at the junior high school level (49.2%) and have children aged 3 and 4 years (42%). Respondents have living children 1–2 children (56%), while the birth distance of children is < 1 year (59.2%).

Variable description

Table 2 explains that most of the respondents have an inadequate eating culture (79.2%) where

Table 1: Respondent characteristics

Characteristics	n	Frequency	Percentage
Level of education	120		
Primary school		25	20.8
JUNIOR HIGH SCHOOL		59	49.2
Senior high school		21	17.5
Bachelor		15	12.5
Child's age	120		
2 years		29	24.2
3 years		42	35.0
4 years		42	35.0
5 years		7	5.8
Number of children	120		
3		45	37.5
More than 3		19	15.8
1-2		56	46.7
Birth distance	120		
<1 year		71	59.2
2 years		29	24.2
More than 2 years		20	16.7

this culture has a category including the frequency of feeding. Most of the respondents gave food to children <1 × (83.3%), with the composition of food types consisting of one type of food (85%).

Table 2: Description of variables

Variable	n	Frequency	Percentage
Frequency of eating	120		
<1×		100	83.3
>1×		20	16.7
Number of types of food	120		
1 type		102	85
>1 type		18	15
Eating culture	120		
Inadequate		95	79.2
Adequate		22	18.3
Perception	120		
Adaptive		24	20
Maladaptive		96	80
Knowledge level	120		
Low		75	62.5
Average		31	25.8
High		14	11.7
Child's age	120		
2 years		29	24.2
3 years		42	35
4 years		42	35
5 years		7	5.8
Parenting model	120		
Uninvolved		37	30.8
Permissive		45	37.5
Authoritarian		22	18.3
Authoritative		15	12.5
Breastfeeding duration	120		
<2 years		81	67.5
2 years		39	32.5
1 st time to get breast milk			
From birth		81	67.5
>1 week		39	32.5
The first age to get complementary food	120		
<6 months		83	69.2
>6 months		37	30.8
The first type of complementary food	120		
Infant formula		82	69.2
Combination of infant formula and other soft foods		37	30.8
The type of supplementary food given first	120		
Solid food		82	68.3
Soft food		17	14.2
Fruit/vegetable juice		21	17.5

At the level of knowledge, most respondents have knowledge about feeding children at a low level of knowledge (62.5%) and have a maladaptive perception of 80%.

Data on parenting models showed that most of them had uninvolved parenting models where the role of parents in making decisions had a very small control room and even tended to ignore good eating culture (30.8%).

Data on breastfeeding showed that most of the respondents gave breast milk from birth (67.5%) with the duration of breastfeeding for <2 years (67.5%).

Meanwhile, data on the complementary feeding were carried out by respondents when the baby was <6 months old (69.2%) with the composition of giving infant formula when the baby was <6 months old (69.2%) and the type of complementary food given when the baby entered that the age of 6 months is a type of solid food such as rice with side dishes according to the family menu (68.3)

Normality test, linearity, homoscedasticity, autocorrelation, and multicollinearity

Based on Table 3, it is found that the classical assumption in the double liner regression test meets the requirements for analysis using this method.

Table 3: Test results of the basic assumption of multiple linear regression

No.	Classical assumption of double linear regression	Significance value
1	Normality	p = 0.23
2	Linearity	p = 0.32
3	Homoscedasticity	p = 0.37
4	Autocorrelation	d = 1.5272
		dU = 1.9052, dL = 1.5272
5	Multicollinearity	
	Frequency of eating	Tolerance: 0.229
	Number of types of food	VIF: 4.361
	Eating culture	Tolerance: 0.275
	Perception level	VIF: 3.640
	Knowledge level	Tolerance: 0.153
	Child's age	VIF: 6.518
	Parenting model	Tolerance: 0.693
	Breastfeeding duration	VIF: 1.443
	The first age to get complementary food	Tolerance: 0.575
	The first type of complementary food	VIF1.738
	1 st time getting breast milk	Tolerance: 0.873
		VIF: 1.146
		Tolerance: 0.487
		VIF: 2.052
		Tolerance: 0.754
		VIF: 1.326
		Tolerance : 0.831
		VIF : 1.203
		Tolerance: 0.631
		VIF : 1.584
		Tolerance: 0.734
		VIF : 1.362

Bivariate and multivariate test

Table 4 explains that there is a very strong positive relationship between the age of the child and the Z score with p = 0.92.

Table 4: Double linear regression test results

Variable	Correlation coefficient	Information
	Sig. two tailed (p < 0.05)	
Frequency of eating	0.06	Very low
Number of types of food	0.40	Low
Eating culture	0.14	Very low
Perception level	0.43	Strong
Knowledge level	0.78	Strong
Child's age	0.92	Very strong
Parenting model	0.09	Very low
Breastfeeding duration	0.62	Strong
The first age to get complementary food	0.18	Very low
The first type of complementary food	0.10	Very low
First age to get breast milk	0.60	Strong

Coefficient of determination, R = 0.916, R² = 0.839, Adjusted R² = 0.803.

There was a strong relationship between the level of perception (p = 0.43), knowledge (p = 0.78), duration of breastfeeding (p = 0.62), and age at first breast-feeding (p = 0.60). While the variable number of types of food has a positive effect, but is low with p = 0.40.

The variables of food frequency ($p = 0.06$), eating culture (0.40), parenting model ($p = 0.09$), the first age to get complementary food ($p = 0.18$), and the type of complementary food given ($p = 0.10$) had a positive but very low correlation.

All variables have a positive relationship with different power levels. This explains that every 1 score increase of each variable is able to increase 1 Z score.

The value of $R^2 = 0.839$ and adjusted $R^2 = 0.803$ it means that all variables can affect the Z score together by 80.3% but 19.7% has affected by another factors.

Table 5 describes that there is a difference in the mean between the treatment group and the control group with a sig. two tailed 0.001.

Table 5: Independent t-test result

Group	Mean	Sig. Levene's test for equality variance	Sig two tailed
Group A	1.202	0.44	0.001
Group B	-2,240		

Discussion

Based on the data, it was found that the frequency had a positive but very low effect on the increase in the Z score in children. The frequency of eating has a relationship with the acceptance of various types of food and minimizes the occurrence of imbalances in eating patterns. Restrictions on feeding children risk the occurrence of a lack of nutritional needs needed by the body, thereby inhibiting the growth of muscle mass, bone mass. The results of the previous studies explained that the frequency of feeding affects the intake of nutrients needed by the body, reducing allergy risk factors [17], [20], [21].

Limitations of feeding in children can interfere with the metabolic processes of basic protein acids such as arginine, glycine, and glutamine and non-essential proteins (asparagine, glutamate, and serine) and six sphingolipids, as well as altered serum glycerophospholipid concentrations so that it detains the process of growth, muscle formation, and body muscle strength. This opinion is in line with research [22], [23].

Preparation of a food menu with several types of food is a method of introducing texture, taste, and adaptation of nutrients to the body. Restrictions on the number of certain types of food reduce the ability to adapt, recognize texture, and taste so that there is a risk of a decrease in body immunity and trigger the outbreak of a disease [24], [25], [26], [27]. Infectious conditions can inhibit the growth process in children. These results are in accordance with the research [24], [25].

Restrictions on the number of types of food trigger disruption of the acceptance of types of food

in the body, causing imbalances in the metabolic processes of essential amino acids, choline, and the synthesis of sphingolipids which have an important role in the formation of muscle and bone growth hormone [23], [24], [30].

Most Indonesian citizens choose rice as a staple food, but some tribes choose corn, cassava, and sweet potato as staple foods to fulfill the calorie needs of the body. The eating culture in this study consisted of a frequency of 3× a day [5], number of types of food, and preparation of food menus. Based on the data obtained, the respondent's eating culture is at an inadequate level, which means that there is an imbalance between the frequency of food, menu preparation, and the number of types of food consumed every day by children. Inadequate eating culture affects minimal indicators of acceptance of diet and nutrition and limits children in recognizing the diversity of types of food and nutrition that children need. This condition has an impact on the Z score in children and increases the incidence of stunting [9].

This opinion has similarities with research conducted by De Onis *et al.*; Haszard *et al.*; and Moraeus *et al.* [11], [31], [32], [10], [30], [31], [8], [28], [29], [8], [27], [28] which provides an explanation that eating culture in the family affects minimal dietary diversity so that it reduces the Z score and body mass index of children [8], [27], [28], [29].

The culture of eating patterns and preparing food menus for children is influenced by family perceptions. Perception is a person's perspective and is believed to be true. From the data obtained, there is information that most of them have a maladaptive perception. This perception is built based on the knowledge obtained and beliefs. The description of the perception in this study is the stage of perception, aspect of perception, and level of perception from parents or caregivers. The perception aspect of most respondents is in the contextual aspect. Contextual perception is obtained from information received from various sources, both valid and invalid sources. This aspect is vulnerable to the truth of information so as to form a maladaptive perception, while the respondent's perception stage is at the experience stage where perceptions are formed based on events that have been experienced by themselves, their families, and the environment in which they live. This stage is vulnerable to the formation of maladaptive perceptions because external events have an incompatibility with individual conditions. Individual perception has a big role in shaping individual behavior.

In this study, most of the respondents had assumptions and perceptions that giving solid food in larger portions could make children healthy, while consuming fish could cause helminthiasis to children. This perception is at risk of parental behavior in preparing children's food diets and has the opportunity to have a bad Z score. This result has been previously reviewed by Abdulahi *et al.* which describes one of the factors that influence the regulation of eating culture in

children is the parent's perception of the composition of food, while especially in ethnic and urban community groups [5], [9], [34], [35].

The level of knowledge, the respondent is at the level of knowledge at the sensory stage, which means that knowledge is obtained through seeing the behavior of others. At this stage, a person receives information without selecting accurate or inaccurate information, so there is a risk of maladaptive behavior changes. Knowledge at the sensory stage is a low level category of knowledge. Behavioral knowledge level affects perception, mindset, adaptation, and decision-making [36], [37]. Thus, parents who have a low level of knowledge or at the sensory stage tend to be less able to plan their children's diet patterns. This condition has an impact on inadequate nutritional intake and is at risk of experiencing nutritional problems, both malnutrition, stunting, and obesity. This opinion is supported by the results of research by Rakotomanana *et al.* [1], [12], [17], [20], [35]. The study explains that the level of knowledge of parents, especially mothers, socioeconomic, and education levels, has a major contribution in providing sources of nutrition and regulating nutrition for children aged 4–6 years.

Age 3–4 years experiences a level of vulnerability to the risk of infection, the occurrence of nutritional and nutritional imbalances, because at this age, children begin to recognize various types of food, in addition, children's ability to choose the type of food they like develops rapidly at the age of 3–5 years. Among them are foods that have unique shapes, bright colors and have a sweet taste, such as snacks, candy, ice cream. Meanwhile, the types of food such as meat and vegetables are some of the types of food that is left out by children. The condition of children is at risk of nutritional imbalances and the possibility of nutritional problems including obesity and stunting. This result is in line with the research of Uwiringiyimana *et al.*; Gol *et al.*; Oumer *et al.*; and Pallalutha *et al.* [24], [30], [38], [39] which explain that the child's ability to choose the type of food is at risk of imbalance in nutritional intake, so assistance and supervision from parents or caregivers are needed.

Parenting model is one of the factors that value the Z score. Most of the respondents applied uninvolved and permissive patterns. Uninvolved is a parenting model where parents do not pay attention to most aspects of growth and development.

Children tend to be left in making decisions, while the permissive model of parents has a submissive role. Both of these parenting models provide opportunities for children to plan, determine dietary patterns that are in accordance with the child's wishes, so that there is a risk of nutritional problems including underweight, stunting, and obesity. This result is in line with the previous research which explains that parenting provides opportunities for the growth process, including nutritional status (normal, underweight, stunting, and obesity) [40], [41], [42], [43], [44].

Breastfeeding has a significant positive effect on the fulfillment of children's nutrition after 3–5 years. In this research, the study of breastfeeding includes the age of first breastfeeding and the duration of breastfeeding. Based on the data, it was found that most of the respondents breastfeeding was given immediately after birth and the duration of breastfeeding was <2 years. Breast milk is the best food for babies at the age of 0–6 months because it has fulfilled the nutritional composition needed and is continued until the age of 24 months. Breast milk is baby food that is easily absorbed so that the baby's needs are fulfilled while increasing the baby's immunity. Thus, the risk of infection in infants is at the lowest level. The condition of a healthy baby has an impact on the maximum growth process and prevents nutritional problems such as underweight, stunting, and obesity. The results of this study have been previously researched by Ayelign and Zerfu 2021; Basri *et al.* [29], [38], [39], [45] which explain that breastfeeding immediately after birth can reduce the risk of infection as well as reduce nutritional inequalities in children up to the age of 2 years. While the duration of breastfeeding is 0–6 months and continued until the age of 2 years, the continuity of breastfeeding for <2 years has an impact on the introduction of types and tastes of food early so that children are able to choose flavors according to tastes such as sweet and attractive colors which risk the occurrence of inadequate nutrition [39], [46], [47], [48].

Early provision of complementary food is at risk for nutritional inadequate where essential protein metabolism is slower than the body's carbohydrate metabolism [49], [23], [28], [50]. This condition has an impact on the delay in the formation of muscle and bone mass and tends to increase fat mass in the body. These results have been previously investigated by Roediger *et al.* [15], Vaivada *et al.* [16], Gholampour *et al.* [19].

The results of the independent t-test showed that there was a difference in the value of the Z score in the treatment and control groups after carrying out the intervention which was one of the menus in the E-stunting application for a period of 1 year. This difference is due to the fact that the intervention menu is a menu that contains prevention interventions and nutritional planning according to the child's Z score, while monitoring each stage of stunting management easily. The application's chat pad feature makes it easy for application users to directly communicate with professional facilitators [24], [25], [39], [50].

Conclusion

E-stunting is able to detect stunting and to determine factors which influence stunting so also can to move parents behavior when they are to give

handling, intervention for their child because e-stunting have a feature which easy to use anywhere and anytime, especially chat feature which can to access health professionals in every time.

E-stunting still needs more improvement in the future to accord health technology development.

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