

ORIGINAL ARTICLE

Determinants of Nutritional Status of Two-Year-Old Infant's First Thousand Days of Life in Work Area of Oepoi Public Health Center, Kupang, Indonesia

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ABSTRACT

Background: Nutritional fulfillment in the first thousand days of life has a big influence on children's intelligence. The prevalence of stunting toddlers in East Nusa Tenggara was shown to be higher than the number of underweight toddlers and there are still children with a very short nutritional status. A short nutritional status of 17.9% shows that the nutritional status of children in the first thousand days of life is still not optimal. The goal to find out the determinant factors of the nutritional status of two-year-old infant's first thousand days of life in the work area of Oepoi Public Health Center, Kupang City, Indonesia.

Methods: This quantitative study used a retrospective cohort design. It enrolled data from June to November 2017 in the work area of Oepoi Public Health Center, Kupang City, Indonesia with a sample of 100 two-year-old infants.

Results: The determinant factors related to underweight or severely underweight nutritional status were exclusive breastfeeding, birth weight, and maternal nutritional status/anemia during pregnancy. The determinant factors related to the body height/age nutritional status were exclusive breastfeeding, early complementary feeding, and maternal nutritional status/anemia during pregnancy, maternal nutritional status/chronic energy deficiency during pregnancy, and colostrum administration. The determinant factors related to the wasting or thinness nutritional status were exclusive breastfeeding, maternal nutritional status/anemia during pregnancy, and ante natal care status.

Conclusion: This study found that all the independent variables were not the determinant factors related to body mass index/age nutritional status.

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Introduction

The promotion in nutrition during the first 1000 days of life (1000 FDL) or *Gerakan 1000 HPK* is every government's effort to improve children's

nutrition and this period is considered a golden or a critical time, if not utilized properly, can cause permanent damages (1). The indicators that serve as the goals are reduction of the number of low birth

weight (LBW), stunting, wasting, overweight, and anemia and increase in exclusive breastfeeding for 6 months (2). Data from the Basic Health Research (Riskesdas) in 2018 revealed the prevalence of national stunting to be 30.8%; including 11.5% of very short and 19.3% of short prevalence rates, where the very short prevalence rate has decreased from 18% in 2013 to 11.5 in 2018 and the short prevalence rate has increased by 0.1% in 2013 (19.2%). The prevalence of body height by age (BH/A) stunting has been higher than the prevalence of underweight or severely underweight [body weight by age (BW/A)] (17.7%) and the prevalence of wasting or thinness [body weight (BW)/TB] (10.2%) in toddlers in Indonesia. The prevalence of stunting toddlers in East Nusa Tenggara (NTT) was reported 42.6% higher than the number of underweight toddlers (17.7%) (3).

This study aims to investigate the dominant factors related to the nutritional status of 1000 FDL of two-year-old infants, and the specific objective was to obtain antenatal care, birth weight, early initiation of breastfeeding (EIB), colostrum administration, exclusive breastfeeding administration, early complementary feeding, anemia status during pregnancy, chronic energy deficiency (CED) status during pregnancy, parity, taboo/abstinence during pregnancy, and the most dominant factor with nutritional status of the two-year-old infants.

Materials and Methods

This quantitative study employed a retrospective cohort design from August to October 2017 with a proportional random sampling technique of 100 people in Oepoi Public Health Center, Kupang City, Indonesia. Oepoi Public Health Center is one of the public health centers in Kupang City with a relatively extensive work area covering Kayu Putih, Oebufu, TDM, and Liliba Districts. The research subjects included mothers who had children aged 6-23 months. The inclusion criteria were being children aged 6-23 months with a health card and a mother-and-child (MAC) book and to be respondent. The exclusion criterion was physical disability. The data included the respondents' identities, their family characteristics, the nutrient intake of the two-year-old infants, their nutritional status, nutritional status during pregnancy, ante natal care (ANC), birth weight, EIB, colostrum administration, exclusive breastfeeding, complementary feeding, CED status during pregnancy, parity, taboo/abstinence for mothers and their infants.

In this study, the nutritional status was measured anthropometrically using four indicators, namely BW/A, BH/A, BW/BH, and body mass index by

age (BMI/A). The nutritional status assessment based on the BW/A index illustrates the relative BW compared to the age of the child. The age is calculated in the full month. BW/A shows the sensitive current nutritional status (when measured) because it is changeable but is not specific because weight is influenced by not only age but also height. BW/A describes underweight, underweight, severely underweight, good nutrition, and excessive nutrition. Body length by age (BL/A) or BH/A index illustrates the previous nutritional status because, in the normal setting, height increases with age.

The data of nutrient intake were obtained from 1x24-hour recall results for 3 times of measurement, respondents' characteristics, taboo/abstinence, family socioeconomic status, history of breast feeding, and complementary food by using a questionnaire. The body weight and length of the two-year-old infants were measured using a length board with an accuracy of 0.1 kg. The MAC book was used to determine the anemia and nutritional status of the mothers of the two-year-old infants during pregnancy. MAC determined the participation of two-year-old infants attending the integrated health services. The data of nutrient intake were processed using Nutrisurvey to determine the relationship between the independent and dependent variables including univariate, bivariate, and multivariate analyses. Chi-Square was applied for bivariate analysis and multiple logistic regression for multivariate analysis.

Results

The average number of two-year-old infants who have a MAC in the health center (from January to March 2017) was 1167 infants. The family characteristics including gender, mother's age, mother's education, father's education, mother's and father's occupation were presented in Table 1. The dominant gender was females as 52 individuals (52%) and the age of the mothers belonged to the no-risk group (20-35 years) as 80 subjects (80%). Sixty one mothers (61%) and 63 fathers (63%) had high educational levels and the highest father's occupation type was self-employed as 49 (49%) and informal workers as 51 males (51%); while the highest mother's occupation category was housewives as 82 females (82%). The ANC indicator was more than 4 times among 99 people (99%), the birth weight of ≥ 2500 g amongst 95 subjects (95%), EIB in 65 individuals (65%), colostrum administration in days 1-4 among 79 people (79%), exclusive breastfeeding in 75 participants (75%), complementary feeding among 26%, and pregnant women with CED in 63 mothers (63%) (Table 2).

Table 1: Characteristics of enrolled families.

Characteristics	n	%
Gender		
Male	48	48
Female	52	52
Mother's age		
Not at risk (>20-35 years old)	80	80
At risk (≤20 and >35 years old)	20	20
Mother's education		
High	61	61
Low	39	39
Father's education		
High	63	63
Low	37	37
Father's occupation		
Army/Civil	4	4
Servant Entrepreneur	49	29
Word worker	13	13
Informal Worker	34	34
Mother's occupation		
Employee	13	13
Informal worker	5	5
HW	82	82

HW: Housewives

Table 2: Characteristics of enrolled respondents.

Characteristics	n	%
ANC		
≥4 times	99	99
<4 times	1	1
BW		
≥2500 gr	95	95
<2500 gr	5	5
EIB		
Yes	65	65
No	35	35
Colostrum administration		
Yes	79	79
No	21	21
Exclusive breastfeeding		
Yes	75	75
No	25	25
Early complementary feeding		
Yes	26	26
No	74	74
CED status		
No	63	63
Yes	37	37

ANC: Antenatal care, BW: Body weight, CED: Chronic energy deficiency, EIB: early initiation of breastfeeding.

Based on BW/A indicators, 88 people (88%) had good nutritional status, while 12 of them (12%) were underweight and severely underweight. Based on BH/A indicators, 68 subjects (68%) had good nutritional status and 32 (32%) were in short and very short nutritional status. Based on BW/BH indicators, there were 79 individuals (79%) with good nutritional status and 21 (21%) with thin

and very thin nutritional status. Based on BMI/A indicators, 83 participants (83%) were with good nutritional status and 17 (17%) with thin and very thin nutritional status (Tables 3 and 4).

Discussion

Nutrition problems are problems in the life cycle, ranging from pregnancy to children aged 24 months,

Table 3: Nutritional status characteristics of the respondents based on four indicators.

Characteristics	n	%
BW/A nutritional status		
Normal	88	88
Underweight/Severely underweight	12	12
BH/A nutritional status		
Normal	68	68
Short/Very short	32	32
BW/BH nutritional status		
Normal	79	79
Thin/Very thin	21	21
BMI/A nutritional status		
Good	83	83
Thin/Very thin	17	17

BH/A: Body height by age, BMI/A: Body mass index by age, BW/A: Body weight by age, BW/BH: Body weight/Body height.

Table 4: The relationship between determinant factors and nutritional status at 1000 FDL.

Characteristics	BW/A		BH/A		BW/BH		BMI/A	
	nutritionalstatus		nutritionalstatus		nutritionalstatus		nutritionalstatus	
	Total	<i>p</i> value	Total	<i>p</i> value	Total	<i>p</i> value	Total	<i>p</i> value
ANC								
≥4 times	99	0.711	99	0.491	55	0.025*	99	0.649
<4 times	1		1		45		1	
BW								
≥2500 g	95	0.048*	95	0.555	95	0.285	98	0.160
<2500 g	5		5		5		5	
EIB								
Yes	65	0.156	65	0.590	65	0.857	65	0.253
No	35		35		35		35	
Colostrum administration								
Yes	79	0.717	79	0.001**	79	0.395	79	0.093
No	21		21		21		41	
Exclusive breastfeeding								
Yes	75	0.04*	75	0.000**	75	0.001*	75	0.282
No	25		25		25		25	
Early complementary feeding								
Yes	26	0.537	26	0.000**	74	0.155	26	0.799
No	74		74		26		74	
CED Status								
No	37	0.320	63	0.022*	37	0.1	37	0.135
Yes	63		37		63		63	

FDL: First day of life, BH/A: body height by age, BW/A: Body weight by age, BMI/A: Body mass index by age, ANC: Antenatal care, CED: Chronic energy deficiency, EIB: early initiation of breastfeeding, *: Significant, **: Highly significant.

or known as the first 1000 days of life, which is the most important period in the life cycle (4). Malnutrition problems that nowadays arise can greatly affect the growth and development of a child. Maternal nutritional status during pregnancy and breastfeeding, maternal health status, and good nutrient intake are determinants to children's physical and cognitive growth and development (5). Nutritional status is a measure of the fulfillment of nutritional needs obtained from the intake and use of nutrients by the body. Assessment of nutritional

status using anthropometric data includes health conditions of individuals or groups determined by the degree of physical needs for energy and other nutrients obtained from food with anthropometrically measurable physical impacts (6).

The increase in body height or length is relatively less sensitive to underweight in a short time. The effect of underweight on height growth has only been seen for quite a long time. Meanwhile, the BW/BH index describes the present sensitive and specific nutritional status that can be categorized as thin,

and this is the best anthropometric measurement (7). ANC visit is a visit of a pregnant woman to a midwife or a doctor as early as possible, since the first time she feels pregnant. The utilization of ANC is deemed to be good, if the total utilization is more than or equal to 4 times (8).

ANC visit is aimed at monitoring the health conditions of the mother and fetus. By doing regular ANC, it will be easier to monitor the growth and development of the fetus in the body. At each ANC visit, the health worker will collect and analyze the data on the mother's condition through history taking and physical examination to obtain a diagnosis of intrauterine pregnancy and the presence or absence of any problems or complications. ANC can help detecting early abnormalities in the mother and fetus by providing health education about the administration of good nutrition and vitamins and minerals as well as iron (Fe) preparations through the 10 T pregnancy ANC exam (9).

Based on the Chi-Square analysis, the ANC determinant factor was only correlated to the nutritional status of the underweight indicators of BW/BH ($p=0.025$). Of 100 samples studied, it was found out that 55 people had mothers who underwent $ANC \geq 4$ times during pregnancy, and the other 45 only underwent $ANC < 4$ times. Of 55 pregnant women who underwent $ANC \geq 4$ times, 7 of them were thin/very thin. Meanwhile, in the group that underwent $ANC < 4$ times, 14 of them were categorized as thin/very thin. Antenatal care is a preventive measure for obstetric health care programs to optimize maternal and neonatal outcomes through a series of routine monitoring activities during pregnancy. If pregnant women wanted an examination through ANC visits, the abnormalities that might arise would be quickly identified and immediately addressed before the adverse effect on pregnancy (10).

One of the goals of this pregnancy check-up was to deliver an infant with normal growth and development. It was shown that there was a relationship between ANC and the nutritional status of toddlers (11). Mothers who had non-standard ANC visits were more likely to have stunting toddlers 2.4 times more when compared to those who had standard ANC visits (12). The results of this study are in line with those indicating a relationship between the history of ANC, the incidence of CED in NTB, and the pregnant women who did not consume iron (13). There was a relationship between the frequency of ANC visits, nutritional status, and birth weight. Pregnant women with ANC visits less than 4 times had the risk of giving birth to infants with LBW (14).

It was demonstrated that the poor quality of ANC and ANC visits may lead to LBW infants. Mothers

with poor quality of ANC and ANC visits had 6 times greater risk of delivering LBW infants as LBW is determinant factor in stunting incidence (15). Another study revealed that ANC access was associated with the stunting incidence in children. It was found that access to ANC had a significant effect on reducing malnutrition in Colombia and Peru. Every pregnancy has a risk of complications in its development. Therefore, according to the standards, ANC must be done routinely to get quality ANC services (16).

Pregnant women who had ANC visits at least four times during the pregnancy period had the advantage of being able to detect early risks of pregnancy, preparing for labor leading to birth, and having good maternal health (17). LBW in toddlers caused an increased risk of underweight, stunted growth and development, and developing diseases such as heart disease, hypertension, and infectious diseases when they are teenagers or adults (18). This is reinforced by the results of the previous study that LBW increased the risk by 2.94 times for toddlers experiencing malnutrition in childhood when compared to toddlers with normal birth weight (19). This is as the study carried out before illustrating that toddlers who had a history of LBW had a risk of malnutrition 5.15 times more when compared to those with good nutrition (20).

It was shown that LBW would lead to underweight toddlers susceptible to infection, which seriously affects the quality of future generations, slowing the growth and development of children. This is supported by other report showing that LBW would lead to a declined immunity and an increased risk of infectious diseases (21). Infectious diseases are the direct causative factors that can affect the nutritional status of toddlers. According to a previous study, LBW is related to the nutritional status, which causes malnutrition in toddlers. Malnutrition is also influenced by food intake and parenting, especially exclusive breastfeeding for toddlers. Programs to reduce the incidence of malnutrition can include counseling about LBW prevention and support for nutrient intake, especially in LBW infants (22). Another study displayed that LBW had a relationship but with a low risk, in which two-year-old infants with LBW had 0.157 times greater risk of stunting in comparison to those with normal birth weight (23).

Ministry of Health recommended that EIB to be done during 30-60 minutes, because most infants would succeed in reaching their mothers' nipples within this period (24). Success in reaching the nipples allows the infants to get colostrum. Nutrients in colostrum are needed by infants in their early lives, including for height growth, because colostrum contains immunoglobulin A protein which can

protect infants up to six months of age. Besides, there are minerals needed by newborns, such as calcium, potassium, and sodium which play a role in bone formation (24). Nutrients in colostrum also help the digestive system to make it easier for the absorption of mineral elements. Therefore, infants who get EIB have more benefits than those who do not, because they get the important elements of colostrum and reduce the risk of stunting. In a study in Kenya, children (aged 0-24 months) who did not have an EIB were twice more likely to experience stunting when compared to those who did. Another advantage gained by the infants with EIB was that they had a greater chance of success in exclusive breastfeeding (25).

This was proven by other researchers in Denpasar that mothers who did EIB were more likely to successfully provide exclusive breastfeeding (26). Based on the findings of the study, the absence of EIB could affect the infant's growth of height because they did not benefit from colostrum, and it was proven that at this age, they could experience stunting or abnormal height. Other results similar to the present one are those about the relationship between EIB, exclusive breastfeeding, and stunting in two-year-old infants aged 7-24 months stating that there was a significant relationship between the implementation of EIB, exclusive breastfeeding, and the nutritional status of stunting children aged 7-24 months (27).

Based on the results of the study on 100 samples, it is known that 75 infants got exclusive breastfeeding, while the other 25 samples did not. Of 75 infants who got exclusive breastfeeding, 10 were in thin/very thin nutritional status and 11 infants from the non-exclusive group were in thin/very thin nutritional category. After being analyzed by Chi-Square test, it was found that the difference of exclusive breastfeeding was significant ($p=0.001$) revealing that exclusive breastfeeding was correlated to nutritional status based on BW/BH indicators. The findings of this study are in line with another study undertaken in 2015 on the relationship between exclusive breastfeeding and nutritional status in infants of 7-8 months old in Tlogomulyo Public Health Center denoting to a significant relationship between exclusive breastfeeding and nutritional status of BW/BH ($p=0.014$). According to this study, breast milk was very suitable to meet the nutritional needs of infants such as fat in breast milk and to be easily digested and absorbed based on the lipase enzyme content (28).

Formula milk does not contain the lipase enzyme because it will be damaged if heated. The main fat of breast milk includes omega 3, omega 6, docosahexaenoic acid (DHA), and amino acids (AA).

The carbohydrate in breast milk is mainly lactose, while the lactose levels in breast milk are much higher than other milk types. Lactose plays a role in the absorption of calcium which is very important for bone growth and development. The protein content in breast milk is whey while cow's milk contains casein. Whey is more easily digested by the infant's intestine in comparison to the casein. This complete breast milk content affects the nutritional status at 100 FDL. Other studies on the relationship between exclusive breastfeeding and the nutritional status of infant aged 6-12 shows that there is a relationship between breastfeeding and nutritional status based on the BW/A index (29).

This is in line with the study conducted by before who investigated the risk factors for stunting in infants denoting to the relationship between exclusive breastfeeding and the incidence of stunting as birth length was the biggest risk factor for stunting (30, 31). Fulfillment of adequate nutrients, for both macro- and micronutrients is needed to avoid or to reduce the risk of stunting. The good quality and quantity of complementary food are important, because it contains a source of macro- and micronutrients that play a role in linear growth (32). Giving foods that are high in protein, calcium, vitamin A, and zinc can enhance children's height (33). The administration of adequate nutrition can affect the normal growth patterns too, so that it can catch up (34). From the results of the study on 100 samples, 26 infants were found to be given early complementary food and 20 infants with a short/very short category ($p=0.0001$). This shows that early complementary feeding is related to nutritional status based on the BH/A indicator (35).

This study was in line with that conducted before about risk factors for stunting in children aged 6-24 months stating that early complementary feeding has a significant relationship with the stunting incidence. Children aged 6-24 months who receive early complementary food were 6.54 times more likely to experience stunting. The early complementary feeding in this study was measured based on the type, frequency, and amount of early complementary food given. The findings showed that the type of early complementary food given did not match the age of the children. The 12-month age group was shown to need a mixed porridge instead of *ulik* porridge. The types of early complementary food given were *ulik* porridge, sun porridge, formula milk, strained porridge, liquid porridge, mixed porridge, and biscuits. The frequency of early complementary feeding did not have a significant relationship with the BH/A nutritional status ($p=0.907$), meaning that the frequency of less than 3 times or more did

not affect the stunting incidence. Meanwhile, the amount of early complementary food given had a significant relationship with the BH/A nutritional status ($p=0.0001$), which is supported by mother's low education of 39% and father's informal job as well as the low food purchasing ability to meet family needs (36).

The setting and quality of food provided to infants are dependent on the mother's educational level and their knowledge on quality of food and food availability at the household level. This study is in line with that carried out before revealing that households with poor nutritional-awareness behavior were more likely to have an increased risk of stunting in toddlers, 1.22 times more when compared to those with good nutritional-awareness behavior. The study on the difference in the level of adequacy of nutrients and the history of exclusive breastfeeding in stunting and non-stunting toddlers found that early complementary feeding had an impact on the success of exclusive breastfeeding, and they had a risk of stunting when compared to toddlers who got exclusive breastfeeding, because in the process of early complementary feeding, it may contaminate the infant's food, and their digestive system may not be ready yet (37).

Poor nutritional status before pregnancy and CED are complicated during pregnancy by energy and nutrient intake deficiency. One factor that can cause a lack of weight gain during pregnancy in the study subjects was the energy and nutrient intake deficiency from the nutrient adequacy score. This deficiency can be due to the mothers awareness not correctly address the complaints of nausea or vomiting during pregnancy. Poor nutritional status in early pregnancy and the risk of CED during pregnancy, followed by weight gain during pregnancy, can result in an increased risk of miscarriage, stillbirth, neonatal death, birth defects, anemia in infants, and newborns with LBW (38).

Of the 100 samples studied, it is known that 63 mothers did not experience CED during pregnancy, and 37 others experienced CED. Of 63 healthy mothers, 15 were short/very short. Meanwhile, in the group that experienced CED during pregnancy, 17 were categorized as short/very short ($p=0.022$). This shows that the nutritional status of the mother/CED during pregnancy is related to the nutritional status based on the BH/A indicator. This study is in line with that conducted in 2013 in Yogyakarta City on the relationship between CED in pregnant women and the stunting incidence in children aged 6-24 months. The study found a significant relationship between the CED of pregnant women and the stunting incidence ($p=0.042$). It was found

that pregnant women who experienced CED were 1.74 times more likely to have stunting. The results of the present study are in line with those showing that there was a significant relationship between CED during pregnancy and the stunting incidence ($p=0.042$) (39). Pregnant women with CED are 4 times more at the risk to give birth to an LBW infant (40). Mothers having CED nutritional status during pregnancy are 5.9 times more likely to deliver LBW infants compared to those who do not have CED too (40).

Conclusion

The determinant factors related to the BW/A nutritional status were exclusive breastfeeding ($p=0.04$), birth weight ($p=0.048$), and maternal nutritional status/anemia during pregnancy ($p=0.001$). The determinant factors related to the BH/A nutritional status were exclusive breastfeeding ($p=0.001$), early complementary feeding ($p=0.000$), and maternal nutritional status/anemia during pregnancy ($p=0.047$), maternal nutritional status/CED during pregnancy ($p=0.022$), and colostrum administration ($p=0.001$). The determinant factors related to the BW/TB nutritional status were exclusive breastfeeding ($p=0.001$), maternal nutritional status/anemia during pregnancy ($p=0.025$), and ANC status ($p=0.025$). This study found that all the independent variables were not the determinant factors related to BMI/A nutritional status. Future researchers are recommended to perform food recall to find out the food intake in two-year-old infants.

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Conflict of Interest

None declared.

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