Low Socioeconomic Households are Vulnerable to Stunting: Structural Equation Model Analysis

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Abstract

Background: stunting is still a problem at the global level. It is estimated 22.2% or 150.8 million of children under five suffering from stunting in 2017. Indonesia is the fourth country with the highest prevalence of stunting in the world (30,8% in 2019). This study is intended to see the structural equation model of determinant stunting of children under two years in Indonesia in 2010 by using data from Indonesia's Basic Health Research 2010. **Method:** we used Structural Equation Model as analysis technique. Stunting determinants that have direct path to the stunting are indicators of care (breastfeeding), food intake (maternal iron tablets, vitamin A in mother and child) and the socio-economic indicators (location of residence, family size, expenditure per capita, maternal education and healthy house). **Results:** the result showed that socioeconomic variable was statistically significant related to stunting with mother's education level and household expenditure per capita as strong indicators to predict household socioeconomic. The regression equation of stunting is -0.18 socioeconomic. **Conclusion:** socioeconomic has negative effect toward stunting. Stunting was more likely occurred in low socioeconomic household.

Keywords: *Stunting, SEM analysis, socioeconomic.*

Introduction

Stunting is still a problem at global level. It is estimated 22.2 per cent or 150,8 million children under five globally affected by stunting. Indonesia is the biggest fifth country of stunting prevalence in the world [1]. Even though the prevalence of stunting in Indonesia in 2018 decreased, but Indonesia is still struggling with stunting (30.8%)[2].

Stunting is related with lots of factors. It was found that 20 – 40 per cent stunting in children under two years related with low birth weight[3]. On the other side, under nutrition might occur because of low birth weight affected by underweight pregnant mothers [4]. Most underweight and stunting occur in a short period from birth until two years of life[5].

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The direct cause of stunting in developing countries was related to the poor nutrition status of mother from the early stages of conception and undernutrition during their pregnancy; inadequate breastmilk, delay of providing additional food, insufficient quality and the amount of additional food and also the combination all of these risk factors [6].

Children suffering from stunting may never grow to their full height and their brains may never develop to their full cognitive potential [7]. Stunted children will grow shorter than their peers and look younger, usually 2 -3 years younger [8]. Mendez dan Adair found that the more severe children suffering stunting, the lower level of their intelligence[9].

Seeing the fact that the prevalence of stunting in Indonesia is still high and realizing how it will impact the quality of Indonesia's young generation, we initiated to analyze nutrition problem in Indonesia particularly stunting in children under two using data from

Indonesia's Basic Health Research 2010[5].

The study was intended to find the risk factors of stunting and its structural equation model of determinant stunting of children under two years in Indonesia in 2010 using data from "Indonesia's Basic Health Research.

Material and Method

Indonesia's Basic Health Research is a cross sectional survey to describe the health problem of population in all areas of Indonesia [10]. Indonesia's Basic Health Research population represents 33 provinces in Indonesia. Samples (household) were selected using two stages sampling method. It represents 33 provinces that spread across 441 districts/ cities out of 497 districts/ cities in Indonesia. In this research, population and sample were total households with children under two years. Total sample included in this study was 7972 samples.

Conceptual framework of UNICEF 1990 [11] was used as theoretical basis of this research. Therefore, the hypothesis structural model was developed accordingly. Variables that were measured in this study consist of parenting which consist of variables giving colostrum, early breastfeeding initiation (infant starts breastfeeding within 1 hour after birth), and exclusive breastfeeding (children aged 0-6 months who were only given breastmilk in 24 hours before interview); macro and micronutrient intake variables consist of fat intake (fat content consumed by children under two in the last 24 hours),Vitamin A for children (children get high doses of vitamin A (100,000 IU for ages 6 -11 months and 200,000 IU for children> 11 months)), Vitamin A for mother (mothers get high dose vitamin A (200.000 IU)), carbohydrate intake (carbohydrate content consumed by children under two in the last 24 hours), Fe tablet (mothers who get Fe pills at least 90 tablets during pregnancy) and protein intake (protein content consumed by children under two in the last 24 hours); and socio economic variables which consists of number of family member, location (urban/ village), mother's education (the highest formal education completed by mother), expenditure per capita (total amount of money spent on food and non-food divided by the number of family members) and healthy house (if it meets seven criteria, namely a ceiling roof, a permanent wall (wall / board), the type of floor is not soil, has windows, adequate ventilation, sufficient natural lighting, and not densely populated, according to Indonesia Health Department standard[12].

Data was analyzed using Lisrel 8.70 and WHO Antro V 3.2 2009 for anthropometric data. Data weighted was processed using SPSS 13 with Complex Method Sample. Flag data in anthropometric was excluded from data analysis since it indicated incorrect measurement[13]. All missing data was excluded.

We used Structural Equation Model (SEM) method for multivariate analysis particularly to create a statistical model that illustrated the relationship between latent variable, exogenous and endogenous variables. Validity and reliability were done simultaneously when creating the statistical model. Multicollinearity was checked using SPSS by identify VIF value and correlation between independents variable.

Findings

Since 410 data were missing and 650 data were flag due to anthropometric measurement, we excluded it from analysis (total 1060 data or 13% out of total sample). There were 76 missing samples due to protein intake, carbohydrates and fat for children variables and those were removed from analysis. Thus, the total sample analyzed was 6836 sample of children under two years.

There was multicollinearity between fat and carbohydrates (r= 0.99) and confirmed by VIF value which is greater than 10. In order to handle the multicollinearity, we created one composite variable instead of exclude these variables[14]. In term of model identification, we found that the measured model is over identified (number of parameters = 33; number of data point= 105, Df = 72). Parameter estimation result (Table 1.) showed us that variables protein, Fat/Carbohydrate and family member had loading factor <0.30 so these

variables will be excluded from analysis.

Table 1. Estimation of Maximum Likelihood Determinants of Stunting Parameters

Parameter	Unstandardized				Standardized
	Loading Factor	SE	t-value	Error variance	Factor Loading
Stunting	1.00	-	-	-	
Fe	0.19	0.0075	25.45	0.11	0.55
Vit A Children	0.30	0.015	20.71	0.70	0.37
Vit A Mother	0.22	0.0089	24.42	0.19	0.48
Exclusive Breastfeeding	0.16	0.0090	18.39	0.13	0.41
Early Initiate Breastfeeding	0.18	0.0099	18.42	0.16	0.41
Colostrum	0.47	0.025	18.87	0.90	0.44
Mother's education	-0.88	0.018	- 49.38	0.99	-0.67
Healthy house	-0.89	0.020	-43.58	1.54	-0.58
Location	0.23	0.0068	34.73	0.20	0.47
Family member	0.38	0.026	14.99	3.18	0.21
Expense	- 0.94	0.018	-51.66	0.97	-0.68
Protein	0.0099	0.0040	2.50	0.066	0.04
Fat/ Carbohydrate	-0.032	0.012	-2.72	0.58	0.05

We found that all of goodness of absolute fit index and parsimony fit index indicated that goodness of fit of model was satisfy except incremental fit (RFI) (Table 2.).

Table 2. Goodness of Fit Index of Stunting Determinant

Goodness of Fit Index	Target of goodness Fit index	Estimation result	Goodness Fit index
Absolute fit index			
GFI	≥ 0.90	0.98	Good
RMR	≤ 0.050	0.039	Good
RMSEA	≤ 0.08	0.045	Good
P (close fit)	≥ 0.05	1	Good

Cont... **Table 2. Goodness of Fit Index of Stunting Determinant**

ECVI	Small value and close to ECVI saturated	M*0.17 S*0.031 I*1.41	Good
Incremental fit index			
AGFI	≥ 0.90	0.97	Good
RFI	≥ 0.90	0.86	Not too good
IFI	≥ 0.90	0.90	Good
CFI	≥ 0.90	0.90	Good
Parsimony fit index			
PGFI	Closer to 1 is better	0.67	Good

In term of validity and reliability, we found that the loading factor value for protein and fat/ carbohydrate intake were 0.0099 and 0.032 respectively (Table 1.). We excluded them due to validity. In term of reliability, the value of error variance is 0.066 which is mean that this variable was not reliable and excluded from the analysis as well.

We found that there were indicators that have standardized loading factors <0.30 and were not valid and reliable for measuring latent variables that are protein, fat/ carbohydrate and family member; consequently, we did model re-specification. Re-specification result shown that there was no negative error variance, no t- value < 1.96 and no standardized factor loading <0.30; thus, there were no more variables excluded from the model. Estimation result for the model after re-specification were satisfy.

All of goodness of fit indexes confirm that the model was compatible with the data. The proposed model (re-specification) was parsimony (PGFI = 0.59); all of goodness of absolute fit index indicate that the overall model was good (GFI = 0.99; RMR = 0,022; RMSEA = 0.026). The incremental fit index was also better than before (RFI=0.96; AGFI= 0.99; IFI= 0.98; CFI= 0.98). We found that all indicator items were valid as well as its reliability (Table 3.).

Table 3. Estimation of Maximum Likelihood Determinants of Stunting Parameters after Re-specification

Parameter	Unstandardized				Standardized
	Factor loading	SE	t-value	Error variance	Factor loading
Stunting	1.00	-	-	-	
Fe	0.19	0.0076	25.38	0.10	0.55
Vit. A Children	0.30	0.015	20.25	0.70	0.36
Vit. A Mother	0.22	0.0089	24.39	0.19	0.48
Exclusive Breastfeeding	0.16	0.0090	18.39	0.13	0.41

Cont... **Table 2. Goodness of Fit Index of Stunting Determinant**

Early Initiate Breastfeeding	0.18	0.0099	18.41	0.16	0.41
Colostrum	0.47	0.025	18.87	0.90	0.44
Mother's Education	-0.91	0.018	-51.54	0.92	-0.69
Healthy House	-0.89	0.020	-43.53	1.54	-0.58
Location	0.24	0.0068	34.95	0.19	0.48
Expense	-0.90	0.018	-49.49	1.06	-0.66

Analysis of Structural Model after Re-specification

The structural model obtained in this analysis is in regression equation as follow:

a. Nutrient intake = 0.22 (parenting) – 0.41 (social economy) à with t-value 6.90 and -16.40 respectively.

b. Parenting = -0.010 (social economy)

c. Stunting = -0.080 (intake) – 0.061 (parenting) – 0.18 (social economy) with t-value -1.69, -1.22 and 4.35 respectively.

Parenting has a positive effect on nutrient intake and it is statistically significant; while social economy has negative effect on intake (statistically significant). We found in this study that the lower the socioeconomic level, parenting and food intake were becoming lower. In addition, food intake, parenting and social economy has a negative effect toward stunting but only socio-economic has a significant association with stunting.

Discussion

Socio economic was statistically having a significant relationship toward stunting. It indicates that socio-economic variables were the main factors as determinants of stunting in children under two years in Indonesia.

Mother's education (loading factor = 0.91) and expenditure household per capita (loading factor = 0.90) are the most powerful indicator to predict household socio-economic status. Study in North Maluku (Indonesia) in 2009[17] found that mother's education has a statistically significant relationship to the incidence of stunting as well as study in Cebu[18]. Research using Indonesian Family Life Survey 1993 – 2007 found that mothers who never attended formal education related with stunting in children 2 – 4.9 years in Indonesia[19]. Study in Indonesia and Bangladesh discovered that maternal and paternal education were strong determinant of child stunting in Indonesia and Bangladesh[20] as well as in Northwest Ethiopia[21].

We found that the higher maternal education, the lower the prevalence of stunting in children. In addition, stunting tends to be higher in household with lower quintile of household expenditure and stunting became lower in those with higher quintile.

Some studies showed us consistent results yet some studies were different. Data analysis using Indonesia's Basic Health Research 2013 found that socioeconomic status which was divided into 5 quantiles were related to stunting in children under two years in Indonesia[22]. When prolonged breastfeeding beyond 12 months interacting with poor economic status of a household potentiated stunting[15]. As addition information, analysis from National Family Health Survey in India concluded that there was no consistent association between the risk of undernutrition and state economic growth[23]. Interesting finding from data analysis of 121 Demographic and Health Survey from 36 countries from 1990 to 2011 was that the contribution of economic growth to the reduction in early childhood undernutrition in developing countries is very small. It challenges the assumption that economic growth will automatically lead to reduction in child nutrition[24].

A path between socio-economic was added directly to stunting to adjust to the objective of study (while in the theory there should not be direct path between socio – economic and stunting). Although socio-economic was statistically significant for stunting, it was not known which intermediary factors that directly affect stunting. Therefore, it is necessary to examine the association of food security, health service factors and environment as well as infections against stunting.

Conclusion

The final model resulted in this study as shown in figure 2. Socio-economic variables are the most important determinant factors of stunting in children under two years where regression equation was stunting = -0.18 socioeconomic. When the socioeconomic is low, the likelihood of experiencing stunting will be higher compared to those who have high socio-economic status.

Ethical of Clearance: The study was based on data available in public domain; therefore, no ethical issue is involved.

Conflict of Interest: There is no conflict of interest in the subject matter or materials discussed in this manuscript.

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