# Path Analysis on the Effect of Biopsychosocial and Economic Factors during Gestational Period on the Risk of Stunting and Development in Children under Five, in Nganjuk, East Java

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**ABSTRACT**

**Background:**There is growing evidence of the connections between slow growth in height early in life and impaired health and educational and economic performance later in life. Basic Health Research (Riset Kesehatan Dasar, Riskesdas) conducted by The Minister of Health in 2010, showed that prevalence of stunting in Indonesia was 35.6% of children aged under five years old. This study aimed to examine path analysis on the effect of biopsychosocial and economic factors during gestational period on the risk of stunting and development in children under five, in Nganjuk, East Java.
**Subjects and Method:** This was an analytic observational study with case control design. This study was conducted at Bagor Community Health Center, Nganjuk, East Java. A total sample of 150 children under five, consisting of 50 stunted children and 100 normal children, was selected for this study by fixed exposure sampling. The dependent variables were stunting and development. The independent variables were middle upper arm circumference (MUAC) and family support at pregnancy, low birthweight, maternal height, maternal schooling, and family income. The stunting was measured by anthropometry (weight for height). The child development was measured by *Kuesioner Pra-Skrining Perkembangan* (KPSP). Other variables were measured by a set of questionnaire. The data were analyzed by path analysis.
**Results:** Low birth weight had direct negative effect on stunting (b=0.99; p=0.897). Maternal height (b=-2.58; p= 0.029), maternal education (b=-1.55; p=0.002), and family income (b=-1.30; p=0.002) had direct negative effects on stunting. Low birth weight (b=-0.27; p=0.253) and family income (b=-0.007; p=0.976) have negative but statistically non-significant effect on development. Maternal education had positive but statistically non-significant effect on development(b=2.16; p=0.883). MUAC (b=-4.60; p<0.001) had negative and statically significant effect on low birth weight. Family support had positive but statistically non-significant on low birth weight(b=0.52; p=0.492). Maternal height had positive and statistically significant effect on MUAC(b=3.16; p<0.001). Family income had positive but statistically non-significant effect on MUAC(b=0.83; p=0.253).
**Conclusion:** MUAC and maternal education have indirect, negative and statistically significant effect on stunting Maternal height, maternal education, and family income, have direct, negative, and statistically significant effect on stunting.

**Keywords:** stunting, biopsychosocial, economic, gestational period

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## BACKGROUND

Growth and development increase rapidly at the age of children under five. This period is often referred as the "Golden Age" phase. At the age of children under five, the cognitive, physical, motoric, and psychosocial aspects of a child develop rapidly (Welasasih and Wirjatmadi, 2012). The

general factors that affect child development are hereditary factors (genetic/ congenital factors, gender, race/ethnicity, and age). Meanwhile, the environmental factors are the gestational period and postnatal environment.

Gestational period needs to be considered in the growth and the development of children under five. Problems faced by mothers before and during pregnancy will increase the risk of stunting in children, where babies have short birth lengths and slow growth in children under five period (Anugraheni, 2012)

Stunting incidence in children under five needs special attention, because it can inhibit the physical and mental development of children. Stunting is related to an increased risk of morbidity, mortality, and inhibition of growth in motoric and mental abilities. Children under five who experience stunting are at risk of decreasing of intellectual ability, productivity, and increasing the risk of degenerative diseases in the future. It is because children who have stunting tend to be more susceptible on infectious diseases; thus, it will be at risk of decreasing the quality of learning in school (Yunitasari, 2012).

Stunting prevalence in Indonesia is still high. Based on the Basic Health Research in 2010, the prevalence of stunting in Indonesia in 2010 was 35.6%; it mostly occured in children aged 2-3 yearsby 41.4% from the total number of population of stunting children in Indonesia (Basic Health Research, 2011). The increase in the prevalence of stunting also occurred from 35.6% (18.5% very short and 17.1% short) in 2010 to 37.2% (18.0% very short and 19.2% short) in 2013.The prevalence rate is still above the threshold (cut off) which has been agreed universally. It will be a public health problem if the prevalence of stunting is >20%. It is also considered as severe problem if the prevalence of stunting is 30–39%. In addition, it will be considered as serious problem if the prevalence is ≥40% (WHO, 2010).

East Java is one of the provinces with high prevalence of stunting in 2015 which was 34.8% (East Java Health Office, 2016). One of the regencies in East Java which had prevalence of stunting with more than 20% in 2015 was Nganjuk Regency by 20.66%. Besides, Bagor Sub-district in 2015 was a sub-district with the highest prevalence of stunting in Nganjuk Regency by 26.3% (Nganjuk Health Office, 2016). The high rate of stunting in children under five in the working area of Bagor Community Health Center needs special attention, because stunting can increase due to unnoticed risk factors.

Biologically, the risk of stunting can be caused by genetic factors, because genes play a role in body size variations inter individual in an ethnic group. It has a high effect on growth in the first few years of life (Johnston, 2002, in Kusharisupeni, 2004). Therefore, parents who are short stature have bigger chance to decrease the risk of children who are short stature. Biologically, the risk of stunting is also caused by prematurity, because the infants weight and body length are affected by the duration of gestational age. According to the result of a study conducted by Meilyasari (2014), gestational age is a risk factor of stunting in children aged 12 months. The premature infants experience slow growth due to short gestational age and linear growth retardation in the womb.

This study aimed to examine path analysis on the effect of biopsychosocial and economic factors during gestational period on the risk of stunting and development in children under five.

## SUBJECTS AND METHOD

This study used an analytic observational study with case control design. This study was conducted on September 5-October 10, 2016, at Bagor Community Health Center, Nganjuk. The variables of this study were maternal height, Middle Upper Arm Circumference (MUAC) during pregnancy, family support during pregnancy, low birthweight, maternal education level, family income, children under five development, and stunting. The source population of this study was children under five in the working area of Bagor Community Health Center, Nganjuk. A total sample of 150 children under five was selected by fixed exposure sampling, with 1:2 ratio between diseased group (case) and non-diseased group (control). This study used questionairres for collecting the data. The data were analyzed by path analysis.

## RESULTS

### 1. Sample characteristics

The results of the study were obtained from 50 children under five as subjects (case group) who were stunting and 100 children under-five as subjects (control group) who were non-stunting. The frequency distribution table of the characteristics of subject of the study was explained in table 1.

**Table 1. Sample characteristics**

| Independent Variable | | n | % |
|---|---|---|---|
| Stunting incidence | Stunting | 50 | 33.3 |
| | Non-stunting | 100 | 66.7 |
| Child development | Appropriate | 120 | 80 |
| | Indecisive | 27 | 18 |
| | Deviate | 3 | 2 |
| Maternal Height | < 145 cm | 10 | 6.7 |
| | ≥ 145 cm | 140 | 93.3 |
| MUAC during pregnancy | < 23.5 cm | 11 | 7.3 |
| | ≥ 23.5 cm | 139 | 92.7 |
| Maternal education | <Senior High School (Low) | 122 | 81.3 |
| | ≥Senior High School (High) | 28 | 18.7 |
| Family income | <Rp 1,411,000/month | 71 | 47.3 |
| | ≥ Rp 1,411,000/ month | 79 | 52.7 |
| Low birth weight | < 2500 gram | 15 | 10 |
| | ≥ 2500 gram | 135 | 90 |
| Family support | Weak | 71 | 47.3 |
| | Strong | 79 | 52.7 |

### 2. Bivariate Analysis

**Table 2. The results of bivariate analysis of biopsychosocial and economic factors during gestational period with the stunting incidence**

| Variable | Case | | Control | | OR | p |
|---|---|---|---|---|---|---|
| | n | % | n | % | | |
| **Maternal Height** | | | | | | |
| < 145 cm | 1 | (10%) | 9 | (90%) | 0.04 | <0.001 |
| ≥ 145 cm | 99 | (70.7%) | 41 | (29.3%) | | |
| **MUAC** | | | | | | |
| < 23.5 cm | 4 | (36.4%) | 7 | (63.6%) | 0.25 | 0.027 |
| ≥ 23.5 cm | 96 | (69.1%) | 43 | (30.9%) | | |
| **Maternal Education** | | | | | | |
| <Senior High School | 9 | (30%) | 21 | (70%) | 0.13 | <0.001 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ≥ Senior High School | 91 | (75.8%) | 29 | (24.2%) | | |
| **Family Income** | | | | | | |
| <Rp 1,411,000/month | 37 | (52.1%) | 34 | (47.9%) | 0.27 | <0.001 |
| ≥ Rp 1,411,000/ month | 63 | (79.7%) | 16 | (20.3%) | | |
| **Low Birth Weight** | | | | | | |
| < 2500 gram | 7 | (46.7%) | 8 | (53.3%) | 2.53 | 0.083 |
| ≥ 2500 gram | 93 | (68.9%) | 42 | (31.1%) | | |
| **Family Support** | | | | | | |
| Weak | 42 | (59.2%) | 29 | (40.8%) | 0.52 | 0.064 |
| Strong | 58 | (73.4%) | 21 | (26.6%) | | |

**Table 3. The results of bivariate analysis of biopsychosocial and economic factors during gestational period with the development in children under five**

| Variable | Case | | Control | | OR | p |
|---|---|---|---|---|---|---|
| | n | % | n | % | | |
| **Maternal Height** | | | | | | |
| < 145 cm | 4 | (40%) | 6 | (60%) | 2.92 | 0.102 |
| ≥ 145 cm | 26 | (18.6%) | 114 | (81.4%) | | |
| **MUAC** | | | | | | |
| < 23.5 cm | 4 | (36.4%) | 7 | (63.6%) | 2.48 | 0.159 |
| ≥ 23.5 cm | 26 | (18.7%) | 113 | (81.3%) | | |
| **Maternal Education** | | | | | | |
| <Senior High School | 16 | (53.3%) | 14 | (46.7%) | 8.65 | <0.001 |
| ≥ Senior High School | 14 | (11.7%) | 106 | (88.3%) | | |
| **Family Income** | | | | | | |
| <Rp 1.411.000/month | 16 | (22.5%) | 55 | (77.5%) | 1.35 | 0.462 |
| ≥ Rp 1.411.000/month | 14 | (17.7%) | 65 | (82.3%) | | |
| **Low Birth Weight** | | | | | | |
| < 2500 gram | 5 | (33.3%) | 10 | (66.7%) | 0.45 | 0.174 |
| ≥ 2500 gram | 25 | (18.5%) | 110 | (81.5%) | | |
| **Family Support** | | | | | | |
| Weak | 15 | (21.1%) | 56 | (78.9%) | 1.14 | 0.744 |
| Strong | 15 | (19%) | 64 | (81%) | | |

## 3. Path Analysis

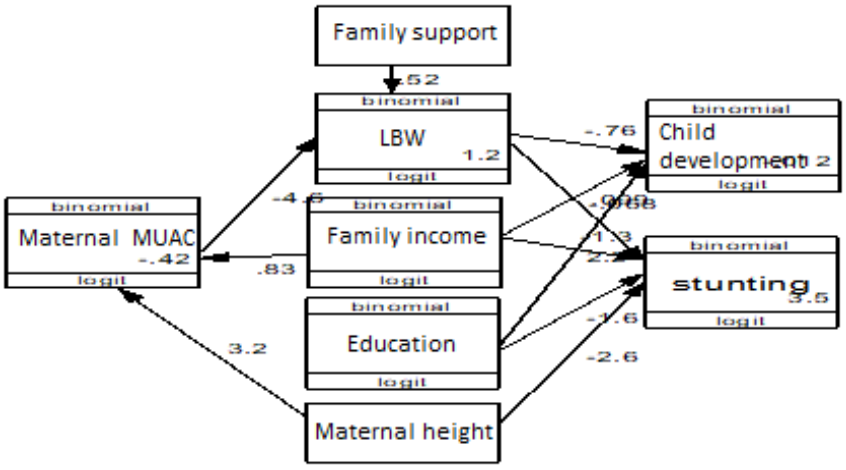


**Figure 1. Path analysis model**

**Table 4 The result of path analysis of the biopsychosocial and economic factors during gestational period on stunting and child development**

| Dependent variable | | Independent Variable | Path Coeffi-cient (b) | (95%) CI | | p |
|---|---|---|---|---|---|---|
| | | | | Lower Limit | Upper Limit | |
| **Direct Effect** | | | | | | |
| Stunting | ← | Low Birth Weight | 0.99 | -1.40 | 1.60 | 0.897 |
| | ← | Maternal Height | -2.58 | -4.91 | -2.59 | 0.029 |
| | ← | Education | -1.55 | 1.23 | 3.09 | 0.002 |
| | ← | Income | -1.30 | -0.97 | 0.83 | 0.002 |
| Development | ← | Low Birth Weight | -0.76 | -2.06 | 0.54 | 0.253 |
| | ← | Education | 2.16 | -0.97 | 0.83 | 0.883 |
| | ← | Income | -0.07 | -0.82 | 0.80 | 0.976 |
| **Indirect Effect** | | | | | | |
| MUAC | ← | Maternal Height | 3.16 | 1.63 | 4.68 | <0.001 |
| | ← | Income | 0.83 | -0.59 | 2.26 | 0.253 |
| Low Birth Weight | ← | MUAC | -4.60 | -6.34 | -2.86 | <0.001 |
| | ← | Family Support | 0.52 | -0.97 | 2.01 | 0.492 |
| N Observation= 150 | | | | | | |
| Log likelihood= -398.68 | | | | | | |
| AIC= 827.36 | | | | | | |
| BIC= 872.52 | | | | | | |

## DISCUSSION

### 1. The correlation between maternal height, stunting, and child development

The result of hypothesis testing showed that there was a correlation between maternal height and stunting incidence which was negative and significant.

Maternal height is the result of complex interactions between genetic factors and environmental factors in their previous years. It is also an important factor which contributes to the child's height. Mothers with shorter stature tend to have stunting children. Maternal height is an indicator that serves to predict children which affected by malnutrition (Ramakrishnan, 2004 in Levy, 2008). Short maternal body posture and poor maternal nutritional status are associated with an increased risk of intrauterine growth retardation (IUGR) which will increase problems of future growth and development in children under five (Black et al., 2008 and Leary, 2004 in Victora, 2008).

The result of hypothesis testing showed the indirect correlation between maternal height and the development in children under five.The indirect effects of correlation were the positive effect of correlation between maternal height and MUAC and the negative effect of correlation between MUAC and low birth weight.

The incidence of stunting greatly affects the social and economic life of the community because it is closely related to the growth and development of children's abilities. A study conducted by Hizni et al (2009) found that stunting in children under five is significantly associated with the development of language skills. Walker et al., (2005) stated that stunting can cause cognitive development disorders. It has proven in a study conducted by Solihin et al., (2013) in Bogor which stated that the decrease of cognitive test scores significant-

ly related to nutritional status (height/age) in children under five.

**2. The correlation between MUAC during pregnancy, stunting, and child development**

The result of hypothesis testing showed that there was an indirect correlation between MUAC during pregnancy and stunting incidence. The indirect effects of correlation were the negative effect of correlation between MUAC during pregnancy and low birth weight and the positive effect of correlation between low birth weight and stunting. It can be concluded that there is a correlation between MUAC during pregnancy and low birth weight which is negative and significant, while a correlation between low birth weight and stunting incidence is positive and non-significant.

The nutritional status in parents, especially in maternal during pregnancy is strongly related to the stunting incidence. According to Proverawati (2009), pregnant women at risk of Chronic Energy Deficiency (CED) are pregnant women who have Mid-Upper Arm Circumference (MUAC) less than 23.5 cm. The limit for measuring MUAC in the women of reproductive age group with the risk of CED in Indonesia is 23.5 cm. If the result of MUAC measurement is less than 23.5 cm, the woman has a risk of CED; otherwise, if the result of MUAC measurement is more than or equal to 23.5 cm, the women has not a risk of CED (Supariasa, 2001). Nutritional status is a state of adequacy and nutrients use that affects a person's health. A person's nutritional status is the result of a balance between consumption of food substances and person's needs (Francis, 2005). This situation affects the fetus she conceived. This is in accordance with a study conducted by Francis (2005), which stated that the nutritional status of pregnant women greatly affects the fetus growth of the fetus she is conceived. If the mother's nutritional status is normal during pregnancy, she has a high possibility of giving birth to a healthy baby, with enough months and normal weight.

The result of hypothesis testing showed that there was there was indirect correlation between MUAC during pregnancy and the development in children under five at Bagor Community Health Center.

The indirect effects of correlation were the negative effect of correlation between MUAC during pregnancy and low birth weight and the negative effect of correlation between low birth weight and the development in children under five. It can be concluded that there is a correlation between MUAC during pregnancy and low birth weight which is negative and significant, while a correlation between low birth weight and the development in children under five is negative and non-significant.

In terms of health and nutrition problems, children under five are children who are in the golden age that have rapid growth and development and susceptible to malnutrition. Various factors can affect the incidence of stunting. The nutritional status of parents, especially maternal nutritional status is closely related to the incidence of stunting. A study conducted by Zottarelli et al., (2007) in Egypt showed that maternal height of <150 cm tends to have stunting children.

**3. The correlation between family support, stunting, and child development**

The result of hypothesis testing showed that there was an indirect correlation between family support and stunting incidence. The indirect effects of correlation were the positive effect of correlation between family support and MUAC, the

negative effect of correlation between MUAC and low birth weight, and the positive effect of correlation between low birth weight and stunting.

Pregnancy is a crisis for family life which is followed by stress and anxiety. Changes and adaptations during pregnancy are not only felt by the mother, but all family members. Therefore, during pregnancy, all family members must be involved, especially husband. Support and affection from family members can give a comfort and safety feeling when the mother feels scared and worried about her pregnancy (Susanti, 2008).

The result of hypothesis testing showed that there was an indirect correlation between family support and the development in children under five. The indirect effects of correlation were the positive effect of correlation between family support and MUAC, the negative effect of correlation between MUAC and low birth weight, and the negative effect of correlation between low birth weight and the develo0pment in children under five.

The psychosocial factors have important role in the first phase of conception, pregnancy, and postnatal in the development in children under five. The critical period starts from the womb until the age of children. Growth and development depends on stimulation, support and parenting style where the children under five live. Stimulation can be used in improving the development of children under five, especially in children under five with low-educated mothers (Barros et al., 2008)

**4. The correlation between low birth weight, stunting, and child development**

The result of hypothesis testing showed that there was a direct correlation between low birth weight and stunting incidence. The direct effect of correlation was the positive effect of correlation between low birth weight and stunting incidence. It can be concluded that there is a direct effect of correlation between low birth weight and stunting incidence which is positive and significant.

Low birth weight is an indicator of public health because it is closely related to mortality, morbidity and incidence of malnutrition in the future, such as the stunting incidence. Babies born with low birth weight are one of the risk factors that have contributed to the death of infants especially in the perinatal period. Babies who have low birth weight can experience mental and physical disorders in the next age of growth and development, so that it requires high maintenance costs.

The result of hypothesis testing showed that there was a direct correlation between low birth weight and the development in children under five at Bagor Community Health Center, Nganjuk. The effect of the correlation was negative, between low birth weight and the development in children under five. It can be concluded that there is a correlation between low birth weight and the development in children under five which is negative and non-significant.

Birth weight is one of the key factors of development in all aspects (Zareian et al., 2014).It is very useful and important in determining and expressing the life expectancy and health factors of children in the future. Low birth weight can be associated with development, education, and adverse behavior in childhood, adolescence, and later on. The most important phase in child development is the phase of infancy and children under five. Children aged 2-5 years are in "Golden Age" phase in the development process, where the cognitive, physical, motoric, and psychosocial aspects of a child develop rapidly (Zaveira, 2008). As a result,

if they have obstructed development, due to the lack of early detection of growth and development, the child will not able to adjust and do the daily tasks. In addition, it also inhibits the academic development of children (Krisdiyanto et al., 2013).

**5. The correlation between maternal education, stunting, and child development**

The result of hypothesis testing showed that there was an indirect correlation between maternal education and stunting incidence through occupation, income, MUAC, and low birth weight.

Education is a way to develop personality and abilities inside and outside school and last a lifetime. The higher the level of education, the easier it is for someone to determine and receive information. The more information received, the more knowledge gained about health. Otherwise, low education will inhibit the development of attitude towards newly introduced values.

The result of hypothesis testing showed that there was an indirect correlation between maternal education and the development in children under five through occupation, income, MUAC, and low birth weight.

Parents with higher education will be more understand how to give the best for children, such as paying attention to their growth. With the high parental education, it is expected to have an open minded for receiving information, especially information about health issues, so that the health status will be better.

**6. The correlation between family income, stunting, and child development**

The result of hypothesis testing showed that there was an indirect correlation between family income and stunting through MUAC and low birth weight. This correlation was negative because most of the respondents of the study only work as housewives, so that the family income comes from the husband's income. The total amount of family income is not all used to fulfill food needs. There is no tendency that high family income is allocated for fulfilling the high food needs, and vice versa. There is no tendency that low family income is allocated for fulfilling the low food needs. Birth weight will affect growth.

The result of hypothesis testing showed that there was an indirect correlation between family income and the development in children under five through MUAC and low birth weight. Development relates to the increase of mental status which is all related to nutritional status, motoric skills, verbal skills, socialization, and independence. Based on study conducted by Rukmana and Indawati (2014), it was found that there is a correlation between socio-economic conditions including income for the development in children under five.

There is a direct and indirect correlation between biopsychosocial and economic factors during gestational period on the stunting incidence and development in children under five at Bagor Community Health Center, Nganjuk.

## REFERENCE

Anugraheni HS (2012). Faktor risiko kejadian stunting pada anak usia 12-36 bulan di Kecamatan Pati, Kabupaten Pati. Program Studi Ilmu Gizi Fakultas Kedokteran Universitas Diponegoro. Semarang.

Barros AJ, Matijasevich A, Santos IS dan Halpern R (2008). Child development in a birth cohort: effect of child stimulation is stronger in less educated mothers. International Journal of Epidemiology. 39 (1): 285-294.

Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, River J (2008). Maternal And Child Undernutrition: Global And Regional Exposures And Health Consequences. Lancet. 371, 243-260.

Dinkes Jatim (2016). Informasi Cakupan Gizi Balita Provinsi Jawa Timur. http://dinkes.jatimprov.go.id/Retrieved in June, 2016.

Francis (2005). Gizi Dalam Kesehatan Reproduksi. Jakarta. EGC.

Hizni A, Julia M, Gamayanti IL (2010). Status stunted dan hubungannya dengan perkembangan anak balita di Wilayah Pesisir Pantai Utara Kecamatan Lemahwungkuk Kota Cirebon. Jurnal Gizi Klinik Indonesia. 6(3): 131-7.

Krisdiyanto E, Arwani, Purnomo (2013). Hubungan pola asuh orang tua terhadap perkembangn motorik anak usia 3-5 tahun.

Kusharisupeni (2004). Peran Status Kelahiran terhadap Stunting pada Bayi. Jurnal Kedokteran Trisakti. 23: 73-80.

Levy, Teresa S (2008). Maternal Characteristic Determine Stunting in Children of Less than Five Years of Age Results from a National Probabilistic Survei. Clinical Medicine: Pediatrics. 1: 43-52.

Meilyasari, Friska (2014). Faktor Risiko Kejadian Stunting Pada Balita Usia 12 Bulan Di Desa Purwokerto Kecamatan Patebon, Kabupaten Kendal. http://eprints.undip.ac.id/44216/1/612_FRISKA_MEILYASARI.pdf. Retrieved in June, 2016.

Proverawati, Atikah (2009). Buku Ajar Gizi Untuk Kebidanan. Nuha Medika: Jakarta.

Riskesdas (2011). Laporan hasil riset kesehatan dasar Indonesia Tahun 2010. Jakarta: Departemen Kesehatan RI.

Riskesdas (2013). Laporan hasil riset kesehatan dasar Indonesia Tahun 2012. Jakarta: Departemen Kesehatan RI.

Rukmana, Umu K, Rachmah I (2014). Kondisi Sosioekonomi dan Demografi Keluarga Pra Sejahtera dan Sejahtera I Di Kota Mojokerto. Departemen Biostatistika dan Kependudukan Fakultas Kesehatan Masyarakat Universitas Airlangga Surabaya.

Solihin, Anwar, Sukandar (2013). Kaitan antara status gizi, perkembangan kognitif, dan perkembangan motorik pada anak usia prasekolah. Jurnal Penelitian Gizi dan Makanan. 36 (1): 62—72.

Supariasa IDN, Bakri B, Fajar I (2012). Penilaian Status Gizi. Jakarta: EGC.

Susanti (2008). Psikologi Kehamilan. EGC: Jakarta.

Victoria, Cesar G (2008). Maternal and Child Undernutrition 2 Maternal and Chils Undernutrition: Consequences For Adult Health and Human Capital. Lamcet Community Health. 55 (6): 394-8.

Walker SP, Chang SM, Powell CA, McGregor SM (2005). Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth stunted Jamaican children: prospective cohort study. Lancet, 366: 1804—1807.

Welasasih BD,Wirjatmadi RB (2012). Beberapa faktor yang berhubungan dengan status gizi balita stunting. The Indonesian Journal of Public Health. 8 (3): 99–104.

WHO (2010). Nutrition Landscape Information System (NLIS) Country Pro-

file Indicators: Intrepretation Guide. Geneva.

Yunitasari L (2012). Perbedaan Intellegence Quotient (IQ) Antara Anak Stunting dan Tidak Stunting Umur 7-12 tahun di Sekolah Dasar (Studi pada Siswa SD Negeri Buara 04 Kecamatan Ketanggungan Kabupaten Brebes). Jurnal Kesehatan Masyarakat. 1 (2): 586-595.

Zareian E, Saeedi F, dan Rabbani V (2014). The Role of Birth Order and Birth Weight in the Balance of Boys Aged 9-11 Years Old. Ann Appl Sport Sci. 2(2): 51-53.

Zaveira, Ferdinand (2008). Mengenali dan Memahami Tumbuh Kembang Anak. Jogjakarta : Katahati.

Zottarelli LK, Sunil TS, Rajaram S (2007). Influence of Parental and Socioeconomics Factors on Stunting in Children Under 5 Years in Egypt. Eastern Mediterranean Health Journal.