Path Analysis on the Relationship Between Bio-psychosocial Factors During Gestational Period and Birthweight, Stimulation and Development in Children Aged 1-3 Years in Salatiga

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ABSTRACT

Background: Bio-psychosocial condition during gestational period, such as maternal nutritional status, stress, education, and family income, may have significant impact on fetal growth and development. The purpose of this study was to examine the relationship between bio-psychosocial factors during gestational period and birthweight, stimulation and development in children aged 1-3 years in Salatiga, using path analysis model.
Subjects and Method: This was an analytic observational study with a case control design. A sample of 120 children aged 1-3 years was selected by fixed disease sampling. The dependent variable was child development. The independent variables were maternal education, family income, maternal stress, maternal nutritional status, birthweight, and stimulation. The data were collected by questionnaire and analyzed by path analysis run on STATA 13.
Results: Child development was directly increased with birthweight ≥ 2.500 g (b= 0.96; 95%CI= −0.15 to 1.94; p=0.054) and good stimulation (b= 0.43; 95% CI= −0.30 to 0.89; p=0.067). Child development was directly affected by family income, maternal education, maternal stress, maternal MUAC, and stimulation.
Conclusion: Child development is directly increased with birthweight ≥2.500 g and good stimulation. Child development is directly affected by family income, maternal education, maternal stress, maternal MUAC, and stimulation.

Keywords: bio-psychosocial, gestational period, birthweight, stimulation, development

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BACKGROUND

Unfavorable conditions during pregnancy, such as nutritional deficiencies, maternal stress, inadequate exercise, and inadequate prenatal care, can lead to an inadequate development of the fetus. The development of an unfavorable fetus is a health risk in later life (Wilkinson and Marmot, 2003 in Murti 2011).

Development is the increasing ability (skill) in the structure and function of the body more complex in a regular pattern and can be called as a result of the process of maturation (Soetjiningsih and Gde Ranuh, 2014).

The child's future quality is determined by optimal child development and growth. Detection, stimulation, and intervention in children should be done early. Motor ability and intelligence of each child is different. Good motor development in children will make children more adapt and adjust to school environment. The ability to adapt to encourage children more able to make friends with others while doing activities. Normal motor development allows the child to play or mingle with his

peers, while the abnormal will hinder the child to get along with his peers even he will be isolated or become a marginalized child (Marmi and Rahardjo, 2012).

According to Adriana (2013), factors affecting growth and development in children are internal factors, external factors (prenatal, delivery, and postpartum factors). Prenatal factors include nutrition, mechanics, toxins, endoctrin, radiation, psychological mothers, while postpartum factors include nutrition, psychological, social environment, and stimulation.

The results of interviews with the midwife coordinator of public health centers in the city said that it does not carry out monitoring of child development because it is more focus on implementing growth monitoring. The impact there is no data report on the problem of child development in Salatiga City. The researcher chose the work area of Tegalrejo Health Center and Sidorejo Kidul Town of Salatiga as a research place by looking at data of problem of high nutritional status in the region.

Children under three years (toddlers) are very energetic and active, full of boundless energy, enthusiastic and curious. Although the rate of growth slows down during this stage, changes in development are important. Improved motor skills allow toddlers to move on their own and explore the environment. Rapid developments in speech and language play a role in improving the ability to think and learn more complex (Allen and Marotz, 2010).

Many questions about child development have not been answered until now. For example what exactly drives the process of biological, cognitive development, and how things that happen in infancy affect childhood.

By looking at the problems of child development and rstudy on factors related to the development of children described by using models of bivariate or multivariate analysis but not yet analyzed gradually to explain the direct and indirect consequences associated with child development, the researcher conducted a research titled " Biopsychosocial Factors Gestational Period with Birth Weight, Stimulation with the development of 1-3 years of age in Salatiga City ".

SUBJECTS AND METHOD

This was an analytic observasional study with a case control design. The study was conducted in Salatiga, Central Java, from October 4 to November 2, 2016. Exogenous variables are maternal education during pregnancy and mother education now. Endogenous variables are family income during pregnancy, current family income, stress in pregnancy, nutritional status of pregnant women, birth weight, and child development.

The target population is mother and toddler in Salatiga City area. Population of study source is mother and toddler in working area of Sidorejo Kidul Public Health Center and Tegalrejo Public Health Center, Salatiga City. A sample of 120 children aged 1-3 years were selected by fixed disease sampling. The data were collected by medical record and questionnaire. The data were analyzed by path analysis run on Stata 13.

RESULTS

1. Sample Characteristics

The results of the study describing the characteristics of the study subjects are shown in Table 1.

Table 1. Sample Characteristics

Characteristics	n	%
Maternal age		
<20 years	2	1.7 %
20 - 35 years	104	86.7%
≥35 years	14	11.7%
Maternal occupation		
Unemployed	88	73.3%
Employed	32	26.7%
Parity		
<2	57	47.5%
≥2	63	52.5%
Toddler age		
12-24 months	71	59.2%
25-36 months	49	40.8%
Number of ANC visit		
<8 times	23	19.2%
≥8 times	97	80.8%
Gestational age		
<36 months	5	4.2%
≥36 months	115	95.8%
Exclusive breastfeeding		
Yes	98	81.7%
No	22	18.3%

Table 2. Frequency distribution of study variables

Variable	Criteria	Frequency	(%)
Education of pregnant women	<Senior High School	28	23.3
	≥Senior High School	92	76.7
Family income	<Minimum regional wage	37	30.8
	≥Minimum regional wage	83	69.2
Stress during pregnancy	No stress	83	69.2
	Stress	37	30.8
Maternal nutritional status	Maternal MUAC < 23.5 cm	22	18.3
	Maternal MUAC ≥ 23.5 cm	98	81.7
Current maternal education	<Senior High School	27	22.5
	≥Senior High School	93	77.5
Current family income	< Minimum regional wage	33	27.5
	≥Minimum regional wage	87	72.5
Birth weight	< 2,500 g	7	5.8
	≥ 2,500 g	113	94.2
Stimulation	Good	64	53.3
	Not good	56	46.7
Development of toddlers	Deviate	39	32.5
	Doubt	62	51.7
	Appropriate	19	15.8

Sample characteristics in Table 1 show the description in the form of classification, frequency and percentage that of 120 mothers majority were at age 20-35 years (86.7%) and unemployed mother (73.3%). Number of children ≥2 (52.5%), children aged 12-24 months (59.2%), ANC ≥8 times (80.8%), gestational age at deli-

very ≥36 months (95.8%), and exclusive breastfeeding (81.7%).

2. Univariate Analysis

Table 2 shows results of univariate analysis. Table 2 shows that majority of mothers had education ≥senior high school (76.7%), family income ≥minimum regional wage (69.2%), (72.5%), low stress in pregnancy (69.2%), and maternal MUAC ≥23.5 cm (81.7%). Mostly, children had birth weight ≥2,500 g (94.2%).

3. Path Analysis

The results of path analysis model are shown in Figures 1 and 3. Table 3 shows the results of calculations using STATA 13.

Normal child development was directly and positively associated with birthweight ≥ 2,500 g (b= 0.96; 95% CI= -0.15 to 1.94; p= 0.054) and good stimulation (b= 0.43; 95% CI= -0.30 to 0.89; p= 0.067).

Family income was positively associated with maternal education during pregnancy ≥Senior high school (b= 1.51; 95% CI= 0.61 to 2.39; p= 0.001) and current maternal education ≥Senior high school (b= 1.20; 95% CI= 0.50 to 1.90; p= 0.001).

Maternal stress reduced with high maternal income during pregnancy (≥Rp1,450,000) and it was statistically significant (b= -1.34; 95% CI= -2.17 to -0.51; p= 0.002).

Maternal MUAC ≥23.5 cm increased with maternal income during pregnancy ≥Rp1,450,000 (b= 1.02; 95% CI= -0.11 to 2.06; p= 0.052) and maternal education during pregnancy ≥Senior high school (b= 0.39; 95% CI= -0.68 to 1.46; p= 0.475).

Maternal MUAC ≥23.5 cm decreased with high stress (b= -0.43; 95% CI= -1.45 to 0.58; p= 0.405).

Normal birthweight (≥2,500 g) increased with maternal MUAC ≥23.5 cm (b= 3.59; 95% CI= 1.41 to 5.78; p= 0.001).

Good stimulation of child development increased with current maternal education ≥Senior high school (b= 0.65; 95% CI= -0.31 to 1.56; p= 0.150) and current income ≥Rp 1,450,000 (b= 0.47; 95% CI= -0.38 to 1.31; p= 0.279).

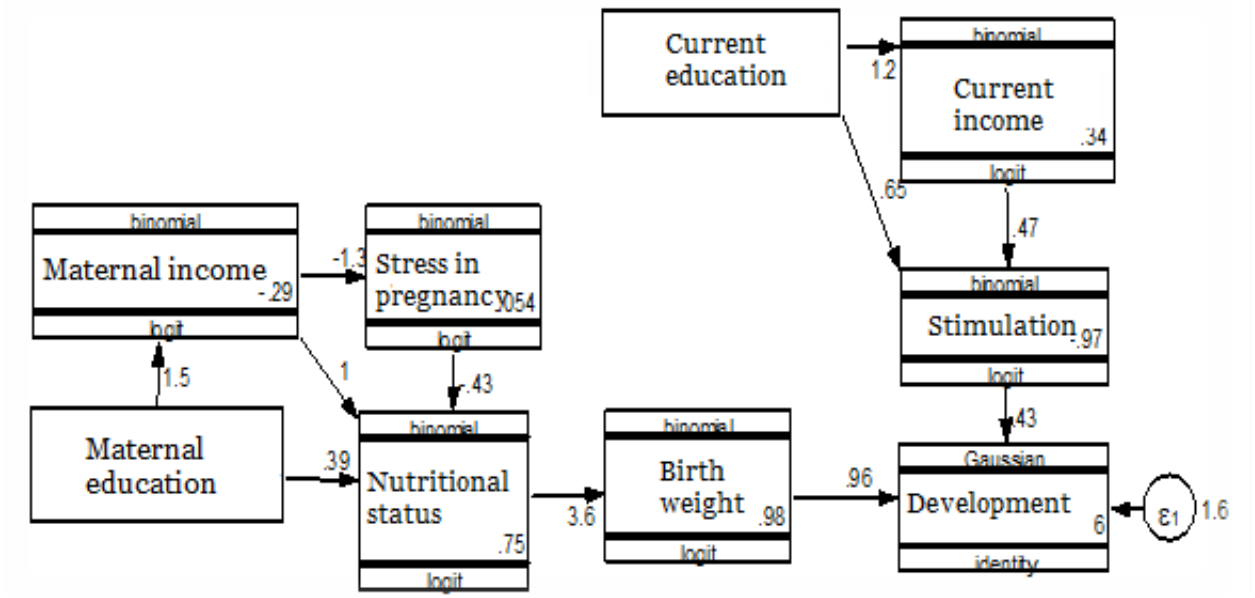

Figure 1. Path analysis model with estimation

Table 3. The results of path analysis model on the biopsychosocial factors associated with development of children aged 1-3 years

Dependent Variable		Independent Variable	Path Coef. (b)	95% CI		p
				Lower limit	Upper Limit	
Direct Effect						
Child development	←	Birthweight ≥ 2,500 g	0.96	-0.15	1.94	0.054
	←	Good stimulation	0.43	-0.30	0.89	0.067
Indirect Effect						
Family income	←	Maternal education during pregnancy ≥Senior high school	1.51	0.61	2.39	0.001
Family income	←	Current maternal education ≥Senior high school	1.20	0.50	1.90	0.001
Stress	←	Maternal income during pregnancy ≥Rp1,450,000	-1.34	-2.17	-0.51	0.002
Maternal MUAC	←	Maternal income during pregnancy ≥Rp1,450,000	1.02	-0.11	2.06	0.052
		Maternal education during pregnancy ≥Senior high school	0.39	-0.68	1.46	0.475
	←	High stress	-0.43	-1.45	0.58	0.405
Birth weight	←	Maternal MUAC ≥23.5 cm	3.59	1.41	5.78	0.001
Stimulation	←	Current education≥ Senior high school	0.65	-0.31	1.56	0.150
	←	Current income ≥Rp 1,450,000	0.47	-0.38	1.31	0.279
N Observation = 120						
Log likelihood = 557.64						

DISCUSSION

1. The relationship between birth weight and child development

There is a direct relationship between birth weight and child development but statistically only close to significant. A study by Chapakia (2016) supported with the results of this study that birth weight affect the development of children.

The study of Carrasco et al. (2016) also supports the results of studies of infants with short stature having low mean language ability and average birth weight infants associated with psycho-motor development.

The results of the study found that there was a relationship between birth weight and child development. This study also supported by Sally et al. (2014) that nutrition and stimulation interventions provide benefits for child development.

2. The relationship between maternal stimulation and child development

There is a direct relationship between birth weight and development but statistically significant.

A study Yousafzai et al. (2016) stated that children who received responsive stimulation had significantly higher cognition, language, and motor skills than children who did not receive responsive stimulation.

However, the results of maternal stimulation and child development are only significantly approximated as many things affect the child's development. This is also supported by studies of Sally et al. (2014); Carrasco et al., (2016) that the provision of nutritional interventions and birth weight of children is related to child development.

3. The relationship between mother education and family income

There is a direct relationship of maternal education to family income and is statistically significant.

The results of study supported Maryanti and Septikasari (2009) that in education there is a learning process so that individuals are actively developing the potential and skills required. Such skills can be used to obtain decent work, so that socioeconomic and educational conditions relate to one another.

A study by Dwiandana and Setiawina (2013), also mentions that education and occupation have a positive and partially significant effect on household income.

4. The relationship between family income during pregnancy and stress in pregnancy

There is a direct relationship of family income to stress in pregnancy and is statistically significant.

The results are supported by Pinel (2009) that when the body is exposed to threats, the result is a set of changes in physiological changes that are generally called stress responses.

Research Brittain et al. (2015), also supports the results of research of pregnant women who have BDI-II scores (measuring stress) showed depression, one of which is influenced by low socioeconomic.

5. The relationship between family income during pregnancy and nutritional status of pregnant women

There is a direct correlation of family income with nutritional status of pregnant women but only statistically significant. The results of the study were supported by Almatsier et al. (2011), which states that family income is associated with poverty, lack of hygiene, health problems and the fulfillment of nutritional needs of pregnant women as food intake during pregnancy determines the nutritional status of pregnant women.

The results were also supported by the study of Liu et al. (2015), with the results of household income having a positive relationship with folic acid intake of pregnant women.

The result of study of family income relation with nutritional status of pregnant mother approaching significant is predicted because nutritional status of pregnant mother there are several factors influencing it. Supported research Ausa and Jafar (2013), with the results of research that there is no significant relationship between family income with SEZ events.

6. The relationship between maternal education during pregnancy and maternal nutritional status

There is a direct relationship between maternal education with nutritional status of pregnant women but not statistically significant.

Maternal education affects the attitude of women to their health, the higher the education the easier to receive information so that more knowledge is owned. Education is needed to obtain information such as health supporting things, so as to improve the quality of life especially food that must be consumed to meet the nutritional needs during pregnancy (Maryanti and Septikasari, 2009; Maulina (2010).

The results of research supported by Liu et al., (2015) that the level of education has a positive relationship with folic acid intake of pregnant women. The result of research about mother education relation on pregnant mother's nutritional status which is not significant allegedly caused by other factors influencing the nutritional status the pregnant mother. The results of Ausa and Jafar (2013) showed no signifi-

cant relationship between education and Chronic Energy Conscience events.

7. The relationship of stress in pregnancy and nutritional status of pregnant women

There is a direct relationship of stress in pregnancy to the nutritional status of pregnant women but statistically insignificant.

The result of study supported by Kalat (2010) that the stress that occurs in a long time will trigger the secretion of cortisol hormone that increases blood sugar and increase metabolism. These changes have the reward of decreasing immune system activity.

The result of study on the relationship of stress in pregnancy with nutritional status of the pregnant mother which is not significant is suspected because of nutritional status the pregnant mother also there are some factors influencing it. Handayani and Budianingrum (2011) research indicate that birth spacing, education, and knowledge of mothers are related to nutritional status of pregnant women.

8. The relationship between nutritional status of pregnant women and birth weight

There is a direct relationship between nutritional status of pregnant women with birth weight and statistically significant. The results of the study were supported by Adriani and Wirjatmadi (2012) that pregnant women with Chronic Energy Deficiency will be at risk of delivering babies with low birth weight (LBW). LBW infants have an increased risk of death, malnutrition, developmental disorders and developmental aberrations.

Study Yongky et al., (2009), also supports with the results of study that the nutritional status of pregnant women affect birth weight.

9. The relationship between current maternal education and mother's stimulation

There is a direct relationship between maternal education with maternal stimulation but is not statistically significant.

The results of research supported by Marmi and Raharjo (2012) which states that high maternal education status will be easier to receive direction to improve child development. A study by Ariani (2013) supports the results of this study that there is a relationship between maternal education with the ability to stimulate gross motor development.

The results of research on maternal education relationship with mother stimulation that is not significant are possible because of stimulation by mother there are several factors that influence. Ariani (2013) states that maternal stimulation is not only related to maternal education but there is also a relationship with the mother's age, work, and socio-economic family.

10. The relationship between current family income and maternal stimulation

There is a direct relationship of family income with maternal stimulation although statistically insignificant.

A study by Romeuli and Vindari (2012) indicates that low family incomes make mothers and children have limitations to play outside of their environment, thus affecting their outlook and narrowing the scope of their association.

The result of research also supported by Ariani (2013) research, with the result of the correlation between socioeconomic condition with the ability of stimulation of gross motor development of baby aged 1-12 months.

The result of the research of family income relation with unimportant mother stimulation is assumed to be influenced by

other factors, as mentioned by Ariani (2013) that maternal stimulation is not only related to the family social economy but also related with age mother, work, and education.

11. The relationship between maternal education during pregnancy and child development through nutritional status and birth weight

There is an indirect relationship between education and child development through nutritional status and birth weight.

The results of rstudy are supported by Marmi and Rahardjo (2012), stating that parental education status, high-education families will more easily receive direction to improve the growth and development of children.

The results of this study also supported the study of Demelesh et al. (2015) that low education affects the pattern of nutritional intake, pregnancy care, and the risk of giving birth to LBW infants. The study of Sally et al. (2014), Carrasco et al., (2016) also supports the results of studies of child birth weight associated with child development.

12. The relationship between family income during pregnancy and child development through nutritional status and birth weight

There was an indirect relationship between family income and child development through nutritional status and birth weight.

Almatsier et al. (2011) states that low socioeconomic conditions affect the course of pregnancy. The effect appears to be greater likelihood of maternal mortality during childbirth or infant death at birth, or low birth weight (LBW) infants.

Demelesh et al., (2015), stated that families with low incomes provide the risk of giving birth to low birth weight infants. The study of Sally et al. (2014), Carrasco et al. (2016) also supports the results of this study.

13. The relationship between stress in pregnancy and child development through nutritional status and birth weight

There is an indirect relationship between stress in pregnancy with the development of the child through the nutritional status of pregnant women and birth weight.

The results of research supported by Cheng et al. (2016); Christine et al., (2012) with the results of research that the incidence of stress during pregnancy whether derived from physical activity, financial burden, physical violence or social environment can increase the risk for low birth weight, which is a risk factor that harms the mother and child.

Van den Bergh et al. (2004) supported the results of the study with 14 independent prospective studies showing the relationship between maternal stress in pregnancy/ stress and cognitive, behavioral, and emotional problems in children.

14. The relationship between nutritional status and development through birth weight

There is an indirect relationship between nutritional status and child development through birth weight. The results of this study was supported Yongky et al., (2009) that the nutritional status of pregnant women affect birth weight. According to Carrasco et al., (2016) the baby's birth agency is associated with future childhood development.

15. The relationship between maternal education now and child development through maternal stimulation

There was an indirect relationship between education and child development through maternal stimulation.

The results of the study were supported by Santrock (2007) that a high level of education causes a person to have more access to information, thus providing different opportunities for the child to get stimulated.

Ariani (2013) shows there is a relationship between maternal education with the ability to stimulate rough motor development of infants aged 1-12 months. Yousafzai et al., (2016) also stated that children who received responsive stimulation had significantly higher cognition, language, and motor skills than children who did not receive responsive stimulation.

16. The relationship between current family income and child development through maternal stimulation

There is an indirect relationship between family income and child development through maternal stimulation. Romauli and Vindari (2012), Santrock (2007) stated that the work of a person with a higher status leads to more access than others and children who get stimulation or stimulation will improve their development.

The results of study also supported by Ariani (2013) that there is a relationship between socio-economic conditions with the ability of stimulation of gross motor development. Yousafzaietal study (2016) showed that children who received responsive stimulation had significantly higher cognitive development, language, and motor skills than children who did not receive responsive stimulation.

The results of this study can be concluded that the development of children affected by birth weight and stimulation. Birth weight is influenced by maternal education, family income, stress in pregnancy, and nutritional status of pregnant women. Stimulation is influenced by maternal education, family income.

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