

Original Paper

Effects of the Mother's Individual Stimulation on the Growth and Development of Infants With Low Birth Weight History



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ABSTRACT

Introduction: Mothers can immediately recognize the strength of their child's development process, thereby, providing early stimulation to the child's physical, mental, and social aspects of growth and development. Therefore, mothers and their skills play a beneficial role in the child's overall development and growth process.

Objective: This study aimed to determine the effect of the mother's independent stimulation on the growth and development of infants.

Materials and Methods: This was a quasi-experimental study with a nonrandomized pretest-posttest design. The study population included mothers and their 0- to 12-month-old infants with a history of Low Birth Weight (LBW) who met the inclusion criteria. The study was conducted in Karang Pule Health Center's service area in Mataram City, Indonesia. The length measuring tools and digital infant scale were used to measure the developmental factors. Also, the prescreening development questionnaire was used to assess the infants' development. The frequency, mean, and standard deviation were used as descriptive statistical analysis, also, the Wilcoxon test was used for bivariate analysis.

Results: The growth and developmental scores of the infants with LBW increased after receiving the independent stimulation from their mothers. The observed changes were as follows: The Mean±SD weight gain of 547.33±1459.40 g, the Mean±SD body length increase of 3.46±6.32 cm, the Mean±SD head circumference increase of 1.65±3.40 cm, and the Mean±SD infants' development increase of 0.83±2.16 cm. Furthermore, the mother's independent stimulation affected the growth (P=0.0001; body length, weight, and head circumference) and the development (P=0.04) of the infants with LBW history.

Conclusion: Mother's independent stimulation significantly influences the growth (body length, weight, and head circumference) and the development of infants with LBW history. Further studies in this area are recommended.

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Highlights

- Children born with low birth weight tend to grow and develop slower, compared with children born with normal weight.
- Infancy is an important developmental period and considered as the fundamental growth that influences and determines the child's subsequent development.
- Mothers' skills and roles are effective in the children's overall development and growth process.
- Stimulation significantly affects children's growth and development.
- Children, who receive regular stimulation, develop faster than children who receive less or no stimulation.

Plain Language Summary

Children born with Low Birth Weight (LBW) tend to grow and develop slower than the children born with normal weight. The first year of life includes the fastest time of growth and development. Infancy as fundamental growth period influences and determines the child's subsequent development. Moreover, mothers' skills and roles are very useful for children's overall development and growth process. Stimulation plays an important role in children's growth and development. There is a critical period in the development process; receiving stimulation during this period helps to develop the child's potentials. Children who get targeted to regular stimulation develop faster than children who receive less or no stimulation. Thus, this study aimed to determine the effect of the mother's independent stimulation on the growth and development of the infants. A total of 30 mothers with their infants who had LBW history participated in this study. The study was conducted in the service area of Karang Pule Community Health Center in Mataram City, Indonesia. The results showed an increase in infants' growth (body weight, body length, and head circumference) after receiving independent maternal stimulation. The independent stimulation by the mother of infants with LBW history affected the infants' growth and development. The present results offer challenges to health policymakers and health professionals, especially midwives. Also, these results may further socialize the independent stimulation programs among mothers of infants, especially infants with LBW history. The socialization programs should also be supported by the provision of adequate health facilities so that the community can access these health service programs. Moreover, the socialization should be accompanied by the provision of sufficient information to mothers who have LBW infants to enable them to detect their infants' growth and development. Thus, the infants' growth and development can proceed normally, according to the age standards.

Introduction

The incidence of Low Birth Weight (LBW) is considered as a public health indicator because LBW is closely associated with mortality, morbidity, and malnutrition in the future [1]. Compared with an infant with normal birth weight, an infant with LBW is 20 times more likely to die during the growth period. In many countries, the infant mortality rate and the incidence of LBW increase simultaneously [2, 3]. The global prevalence of LBW is 15.5%, indicating that about 20.6 million babies with LBW are born every year. Also, 96.55% of these newborns are in developing countries, including Indonesia. The highest

incidence (27.1%) occurs in Central and South Asia, while the lowest incidence (6.4%) occurs in Europe [4].

In Indonesia, the national prevalence rates of LBW were 11.1% and 10.2% in 2010 and 2013, respectively. Although the prevalence rate has decreased in this country, it is still high and needs serious attention. Children born with LBW tend to have slower growth and development than children born with normal weight. The LBW leads to the shortness of height and stunting. Stunting is a chronic malnutrition problem caused by a lack of nutrition in a long time, where the food does not meet nutritional needs. The prevalence of stunting nationally increases by 1.6%. This prevalence rate is higher than that of the malnutrition and poor nutrition (17.9%), thinness (13.3%), and obesity (14%) [5].

Infancy as fundamental growth period influences and determines the child's subsequent development. Also, the mothers' skills and roles are beneficial for the children's overall development and growth. There is a critical period in a child's development in which the stimulation is needed to develop the child's potentials. Children who receive regular stimulation will develop faster than children who receive less or no stimulation [6].

Each child passes a unique process of growth and development because many genetic (biological) and environmental (psychosocial) factors affect the child's development. Stimulation is considered as one of the psychosocial factors that affect children's growth and development. Children who receive direct and regular stimulation develop faster than children who receive less or no stimulation [7].

Studies show that maternal stimulations positively affect infants' gross motor development and lead to normal gross motor development. Hence, parents' stimulation is significantly correlated with the growth and development rates in toddlers who have 1 to 3 years of age and the LBW history [8, 9].

According to the report of Karang Pule Community Health Center (Mataram City, Indonesia), all the children aged 0 to 59 months were weighed in November 2017, and a total number of 4574 toddlers were targeted in Karang Pule Village. Out of this population, 650 and 116 children (about 16.7% and 3.0%, respectively) suffered from malnutrition and severe malnutrition, respectively [10]. Furthermore, the incidence of infant malnutrition and severe malnutrition was mostly associated with the history of LBW, based on the interviews of the nutrition officer of the Karang Pule Community Health Center. In 2017, a total number of 40 babies were born with LBW in Karang Pule Community Health Center, also, one baby died because of severe asphyxia. Thus, the present study aimed to determine the effect of the mother's independent stimulation on the growth and development of infants.

Materials and Methods

This was a prospective analytical study with a quasi-experimental design with a pretest-posttest (no control group). The study population consisted of mothers who had infants with LBW history. Also, this study was conducted in the service area of Karang Pule Community Health Center, Mataram City, Indonesia, from June to September 2018. In quantitative studies, a minimum sample size of 30 is required to enable the use of statistical tests [11]. Therefore, 30 mothers and their 0-

to 12-month-old infants who had the LBW history were selected through the purposive sampling method. Besides, the inclusion criteria were as follows: the infant's age of 0 to 12 months, the history of LBW for infants, the good health of infants, the willingness of parents for participation (during 30 days), and the parents' ability to perform the intervention as had been demonstrated and taught by the authors.

The study data were collected at the pretest and post-test. The primary data were obtained from the respondent identity sheet. Moreover, the growth data were obtained by the measurement of infant body length, head circumference, and weight. Also, the authors and enumerators used the Prescreening Developmental Questionnaire (PDQ) to collect the developmental data, before the intervention. Secondary data were obtained from the infants and toddlers cohort and the handbook of Mothers and Infants Health. Stimulation for the growth and development of the infant was independently carried out by the mothers who provided infant massage stimulation. Using video and flipcharts, the mothers were trained to carry out infant massage. Before independent stimulation, the mothers were also trained for infant development, based on the Mothers and Infants Health handbook.

The observations were made two times, before and after the treatment (with four weeks interval). Initially, all the mothers signed the research informed consent. At the pretest stage, the previously sampled infants were assessed for body lengths, head circumferences, body weights, and development. The lengths, weights, and development were measured with the measuring tool, digital baby scale (Onemed), and the PDQ, respectively.

In the training sessions, the mothers were grouped, based on their living regions. During the infant massage demonstration, the mothers were encouraged to ask about anything unclear in the massage technique. After the training sessions, the authors evaluated and observed the mothers while they were carrying out the massage. The infants received intensive massage twice a day (morning and evening), in 15 to 20 minutes sessions, for 30 days. The mothers (as the respondents) applied the infant massage directly on their babies, while the families and the nearest neighbors of the respondents acted as supervisors during the 30 days.

The authors and enumerators controlled and checked the study participants twice a day. The enumerators were three students from the Department of Midwifery, Diploma IV Study Program, Poltekkes Kemenkes Mata-

ram, Indonesia, and had received the knowledge of infant massage and the study process. Also, their tasks were to check whether the intervention was carried out by the respondents. After 30 days, authors and enumerators measured the length, weight, head circumference, and development of the infants, at the posttest stage. After the data and measurement results were obtained, the authors analyzed the data.

Data analysis was performed in SPSS-16 for Windows (licensed copy owned by TEAM EQX 6th Birthday, 1337). The frequency distribution, minimum, maximum, mean, and standard deviation were used as univariate analysis, also, the Wilcoxon test was applied as bivariate analysis.

Results

According to Table 1, most participated mothers (60%) have 20 to 35 years of age, also 22 mothers (73.3%) reported that they do not work. The working mothers mostly were traders, entrepreneurs, and teachers. Most mothers reported an intermediate level of education (i.e., senior high school), and only four mothers (13.3%) had a higher level of education. Besides, most infants (46.7%) were in the age range of 0 to 3 months and they were mostly female (60%).

The infant growth factors (body weight, body length, and head circumference) increased after receiving independent maternal stimulation (Table 2). The independent stimulation by mothers increased the growth and development factors of infants. The observed changes were as follows: The Mean±SD weight gain of 547.33±1459.40

Table 1. Frequency distribution of the characteristics of mothers and infants with LBW history

Variables	No. (%)	
Mother's age (y)	<20	7 (23.3)
	20-35	18 (60)
	>35	5 (16.7)
Occupation	Working	8 (26.7)
	Not working	22 (73.3)
Level of education	Low (not at school, elementary school, junior high school)	12 (40.0)
	Intermediate (senior high school)	14 (46.7)
	High (D1, D2, D3, S1, S2, S3)	4 (13.3)
Infant's age (m)	0-3	14 (46.7)
	3-6	9 (30)
	6-9	7 (23.3)
Gender	Female	18 (60)
	Male	12 (40)

Table 2. Distribution of infants' growth before and after receiving independent stimulation

Variables	Before the Intervention			After the Intervention			Sig.*
	Max	Min	Mean±SD	Max	Min	Mean±SD	
Weight (g)	8400	2280	5067.67±1688.51	8000	2800	5615±1459.40	0.0001
Body length (cm)	69.90	47	58.83±7.07	80	50	62.29±6.32	0.0001
Head circumference(cm)	47	32	39.17±3.76	48	34	40.82±3.40	0.0001
Development	10	1	7.20±2.84	10	4	8.03±2.16	0.04

* The Wilcoxon signed-rank test.

g, the Mean±SD body length increase of 3.46±6.32 cm, the Mean±SD head circumference increase of 1.65±3.40 cm, and the Mean±SD infant development increase of 0.83±2.16 cm. Before receiving the independent stimulation, the lowest and the highest values of development were 1 and 10, respectively; these values changed to 4 and 10 after the independent stimulation.

The Wilcoxon signed-rank test indicated a significant difference ($P=0.0001$) between the pretest and posttest in the growth variables (weight, body length, and head circumference). Thus, the mother's independent stimulations have affected (with $\alpha=0.05$) the growth of infants with LBW history. Again, the Wilcoxon signed-rank test showed a significant effect ($P=0.04$) of the mother's independent stimulation on the development of infants (Table 2).

Discussion

The results showed an increase in the infant's mean body weight after receiving the mother's independent stimulation. However, the heaviest weights of infants before and after the independent stimulation were 8400 and 8000 g, respectively. This reduction is owing to the presence of five infants who caught a fever. Out of the five infants who caught a fever, two did not gain weight and three gained weight after receiving the independent stimulation from their mothers.

Good nutrition was another factor affecting the development of these infants. The nutrition provided by their parents fulfilled the nutritional needs of the infants, hence, the infant became normal. They achieved the standard motor development, according to age, health status, intelligence level, behavior, and attitude. The lack of nutritious food delays growth and development. However, good nutrition and health status prepare the baby and support motor development.

Massage treatment leads to a 20% increase in body weight, compared with the control group [12]. Massage acts through a mechanism that increases the activity of the vagus nerve and hormones, such as IGF-1, gastrin, and insulin. These changes affect the weight gain in infants. A study in Indonesia has shown a significant increase in infant weight after receiving massage treatment [13].

In this study, most infants were 0 to 3 months old and female, however, the previous studies report inconsistent results in the development of infants, regarding the age range and sex. Infant development was measured with PDQ in infants aged 0 to 12 months. The change in PDQ

scores, after receiving the mothers' independent stimulation, showed an increase in the infant development

Our results showed deviations in some infants even after receiving their mothers' independent stimulation. The LBW history caused these deviations. The growth and development of infants with LBW history should be monitored continuously. The monitoring would prevent the decline in intellectual abilities and productivity, the risk of degenerative diseases, the birth of LBW infants, and enhance future development. The incidence of delays in motor development is 27.6 times higher in toddlers with LBW history, compared with normal toddlers.

The mother's education and occupation are two demographic factors that influence the development of infants. Mothers with good education easily receive information on how to provide care and stimulation for their babies. However, it is not the same for the occupation. Mothers who do not work have enough time to pay attention to the infants' needs and provide optimal stimulation, thus, their infants develop normally. This fact is consistent with the results of the present study. In this study, the mothers of normal infants mostly reported an intermediate level of education (senior high school) and having no job (housewives). Thus, these mothers provided independent stimulation to their infants.

Our results indicated that the mother's independent stimulation affects the growth (body length, body weight, and head circumference) of infants with LBW history, in the service area of Karang Pule Community Health Center, Mataram City, Indonesia.

Infants need the stimulation that supports the development process. Infants who receive enough direct stimulation develop faster than those who receive less or no stimulation. This condition occurs because the provision of good stimulation by the mother supports the infant's development. The low levels of mothers' education negatively influence the infants' stimulation. Mothers with low levels of education cannot get information on how to provide care and stimulation for infants and maintain the health of their infants. Although many factors, such as education, work, culture, and past experiences affect the development of the infants, it is possible to have an infant with normal development [6]. The provision of appropriate stimulation is one of the factors that strongly affects the development of the infant.

The results of the present study are in line with several previous studies in Indonesia and other countries. In Indonesia (Palembang City), a cross-sectional study

found a significant relationship between parental stimulation and the rates of growth and development in toddlers with LBW history (aged 1 to 3 years) [8]. Also, a qualitative study on 23 articles has investigated the effect of massage therapy on the premature neonates of the NICU; most studies report the beneficial effects of the various forms of massage therapy on the growth factors of premature babies. The other benefits of massage therapy for premature infants in hospitals included the better nerve development, the positive effects on brain development, the reduced risk of neonatal sepsis, the reduced length of hospitalization, and the reduced neonatal stress [13]. A study in Iran found that the infants of the massage group had lower transcutaneous bilirubin levels, compared with the control group. The results of this trial test shows that newborn massage is associated with lower bilirubin levels, in healthy newborns [14]. The results of another study in the Midwifery Clinic of the Atatürk University Hospital shows that infant massage increases the attachment between mother and baby [15].

A study in Banyumas Regency, Indonesia, found that the empowerment model impacts on toddler growth (body weight, body length, head circumference, and upper arm circumference too). Also, family and social support positively affect the social personal, language, and motor development of toddlers [16].

According to a study in the Teaching Hospital of Dhaka Bangladesh, the majority of neonatal death cases are related to prematurity, asphyxia, and other complications [17]. Another study in India found that anemia in pregnancy has fetal outcomes, including reduced birth weight and increased perinatal morbidity and mortality associated with complications and perinatal asphyxia [18].

Our results indicated that the mother's independent stimulation affects the development of infants with LBW history. However, the results differ from the results of a previous study conducted in Indonesia [19]. This study found no relationship between LBW history and the growth and development of students.

Our study results are consistent with the study results recently conducted in Indonesia. The recent study found a relationship between LBW history and the development of preschooler children (aged four to five years). Also, other confounding variables were the gestational age, birth weight, parental education, and parental stimulation [20]. Receiving massage therapy from mothers enhances the psychomotor development and growth in infants with LBW [21]. Moreover, the applica-

tion of the empowerment model significantly impacts the development of social personal, language, and gross motor abilities in children [16].

No difference has been reported in nutritional status and development between under 5-year-old toddlers with and without the LBW history [22]. However, early stimulation is associated with the development of independence in pre-school children [23]. Furthermore, a positive relationship has been observed between the stimulation and the development of children aged one to three years [24, 25]. Yet, it has been shown that the birth weight does not affect the gross motor development of toddlers aged two to three years; various factors affected the gross motor development of these toddlers [26].

This study included several limitations, such as the non-randomized sampling method, the absence of a control group, the small sample size, and the purposive sampling method. In this study, most infants were 0 to 3 months old and female; however, the previous studies report inconsistent results in the development of infants, regarding the age range and sex. Also, the results indicated that the mothers' independent stimulation affects the growth and development of infants with LBW history, in the service area of Karang Pule Community Health Center, Mataram City, Indonesia.

Based on the results of this study, the program of mothers' independent stimulation needs to be socialized to mothers of infants, especially infants with LBW history. Also, the socialization program should be supported by the provision of adequate health facilities to improve community access to the health service program. Moreover, sufficient information should be provided to the mothers of infants with LBW to enable mothers to detect the growth and development of their infants. Thus, the infants' growth and development can proceed normally, according to their age standards.

Ethical Considerations

Compliance with ethical guidelines

Ethical approval for this study was obtained from the Medical Research Ethics Committee of the Faculty of Medicine, the University of Mataram (No: 171/UN18.8/ETIK/2018). Also, written informed consent was signed by all mothers of infants before the study procedures.

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Authors contributions

Conception, design, analysis, interpretation, the drafting of the article, the critical revision of the article for important intellectual content, and the final approval of the article: Linda Meliati; The obtaining of funding, the collection and assembly of data, and statistical expertise: Ni Putu Karunia Ekayani; Administrative, technical, and logistic support, and the collection and assembly of data: Siti Khadijah.

Conflict of interest

The authors declared no conflict of interest.

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