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RELATIONSHIP BETWEEN MATERNAL ZINC INTAKE, NUTRITIONAL STATUS, EXCLUSIVE BREASTFEEDING AND STUNTING IN 6 MONTH OLD INFANTS

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ABSTRACT

Stunting is a form of malnutrition that has an impact on decreased learning achievement, motor, mental and intellectual development. Exclusive breastfeeding is a perfect nutrition for the First 1,000 days of life for normal growth. Maternal nutritional status also plays an important role for the success of breastfeeding whose indicators are measured by the duration of exclusive breastfeeding and the nutritional status of children. Adequacy of zinc is an important micronutrient during the child's growth period to prevent growth failure. The current study aimed to analyze the relationship between maternal zinc intake, nutritional status, exclusive breastfeeding and stunting in 6 month old infants. This cross-sectional study was conducted in Fallujah Teaching Hospital on 90 infants aged 6 months and their mothers. Zinc intake data was obtained by the 24 hours recall. Body mass index was used to obtain data on maternal nutritional status. The stunting data measured by microtoise, and the other information were collected in a questionnaire form. Exclusive breastfeeding (OR=0.53; p=0.192) and maternal zinc intake (OR=0.83; p=0.913) directly decreased the risk of stunting in infants. Maternal BMI indirectly affected the risk of stunting in infants through exclusive breastfeeding (OR=3.28; p=0.006). It can be concluded that exclusive breastfeeding and maternal zinc intake directly decrease the risk of stunting in infants. Maternal BMI (Body Mass Index) indirectly affects the risk of stunting in infants through exclusive breastfeeding.

KEYWORDS: Exclusive breastfeeding, nutritional status, zinc intake, stunting.

INTRODUCTION

Stunting is a nutritional problem in the world, especially in poor and developing countries (UNICEF, 2013). Malnutrition is still the highest health problem in developing countries (Banerjee and Chattopadhyay, 2019). There is 22.2% of stunting in the world. In 2017, more than a half of stunting children came from Asia (56%). The highest percentage was in South Asia by 58.7% (UNICEF et al., 2018).

WHO 2010 has a limit for the stunting problems with no more than 20%. However, the preventive actions are still being carried out to prevent an increase of stunting in the next year. It aims to reduce the effect of stunting that is directly related to an increase in morbidity and mortality, stunted mental growth (UNICEF, 2013), inappropriate motor development,[5] decreased learning achievement of children (Septiawahyuni and Suminar, 2019), risk of being susceptible to non-communicable diseases (Souganidis, 2012), and decreased intellectual ability and risk of degenerative diseases (Kusuma and Nuryanto, 2013). In addition, it inhibits economic growth and decreases the work productivity; as a result, it causes in intergenerational poverty (TNP2K, 2017).

Stunting largely occurs due to inadequate nutrition during the first 1,000 days of life. Therefore, it is important to pay attention to the patterns of infant feeding during the period of 1000 days of life starting from conception to the second year which has a significant effect on infant growth. Breast milk is an ideal and balanced nutrition according to the infant needs during the first 6 months of life (Ferreira et al., 2013).

WHO recommends exclusive breastfeeding for 6 months. Breast milk is the perfect nutrient for linear growth. Based on the global level, the coverage of exclusive breastfeeding is still 30%, while the WHO target in 2025 related to the level of exclusive breastfeeding in the first 6 months of life is 50%.

The nutritional status of breastfeeding mothers plays an important role for the success of breastfeeding. The indicators are measured by the duration of exclusive breastfeeding and infant growth (Syafiq et al., 2015).

Adequacy of zinc is one of the important things during the infant growth period. If there is zinc deficiency, the growth failure will occur (Roohani et al., 2013). Besides, infant development is also affected by higher mineral intake in the composition of breast milk (Huang et al., 2016). Zinc is a mineral that is very important for the linear growth of infants. It is because there is an association between the increase of IGF-1 and zinc mineral (El-Farghali et al., 2015).

SUBJECTS AND METHODS

This cross-sectional study was conducted from February to March 2019 in Fallujah Teaching Hospital / Iraq on 90 infants aged 6 months and their mothers, and samples were collected by cluster sampling technique. In addition, simple random sampling was used to collect the sample. The dependent variable was stunting, while the exclusive breastfeeding, maternal nutritional status and maternal zinc intake were the independent variables.

Exclusive breastfeeding was breast milk given to babies from birth until 6 months of age without adding and/or replacing with other food or drinks. Measuring instruments using questionnaires and Card toward Health book. Data of exclusive breastfeeding were obtained by interview method. The measurement scale was a dichotomy. Code 0 was for exclusive breastfeeding and 1 was for non-exclusive breastfeeding.

Maternal nutritional status was a physiological condition of the body as a result of food consumption and nutrients in the body. It was measured by anthropometry of body weight and height. In addition, it was interpreted based on BMI. It used weight scale and microtoise. Data of maternal nutritional status were obtained by direct measurement. The measurement scale was continuous, but it was changed to dichotomy to analyze the data. Code 0 was for normal nutrition (BMI 18.5 to 25 kg weight /m^2 height and 1 was for abnormal nutrition (BMI <18.5 kg weight/m^2 height).

Maternal zinc intake was the amount of zinc-containing food in each menu consumed using Estimated Food Record procedure. It was converted to grams through the Nutri survey application. It was measured by a questionnaire. Zinc intake data obtained by 24-hour recall method. The measurement scale was continuous, but it was changed to dichotomy. Code 0 indicated adequate nutritional intake if ≥ 77% of RDA (15 grams/day), and 1 indicated inadequate zinc intake if < 77% of Recommended Dietary Allowances (RDA) (15 grams/day).

Stunting was a measure of body length with a centimeter (cm) unit. It was interpreted using a graph of body length growth according to age and sex of the infants. The measuring instrument was meter in cm. Data of zinc intake status were obtained by direct measurement method with supine infants. The measurement scale was continuous, but it was changed to dichotomy. Code 0 indicated non-stunting (> 2SD) and 1 indicated stunting (<-2SD).

Statistical analysis

SPSS v.21 was used for data analysis. The characteristics of continuous data were described in n, mean, SD, min, and max. The characteristics of categorical data were described in number and percentage.

RESULTS

Table (1) showed that the maternal age ranged between (17-35) years with a mean of 24 years. The maternal BMI ranged between (15.81 - 25.00) kg weight/ m^2 height with a mean of 20.1 kg weight/m^2 height. The maternal zinc intake ranged between (4.01-15.43) grams/day with a mean of 8.45 grams/day. The infants' body length ranged between (54 -74.5) cm with a mean of 60.45 cm.

The number of female babies was (55.6%) in comparison with the male babies (44.4%). The number of babies who were given exclusive breastfeeding was (62.2%), which was higher than babies who were not given exclusive breast feeding (37.8%) as shown in tables (1).

Table (1): Sample characteristics.

Variable	N	Mean	SD	Min	Max
Maternal age (year)	90	24.34	3.95	17	35
Maternal nutritional status (kg BW/m^2)	90	20.1	3.21	15.81	25.00
Maternal zinc intake (gram)	90	8.45	2.98	4.01	15.43
Infant body length (cm)	90	60.45	5.12	54.00	74.50

Variable	Category	n	%
Sex	Male	40	44.4
	Female	50	55.6
Exclusive breastfeeding	Non-exclusive breastfeeding	34	37.8
	Exclusive breastfeeding	56	62.2

The distribution of the relationship between exclusive breastfeeding, maternal nutritional status, maternal zinc intake and stunting in infants aged 6 months can be seen in table (2).

The result of bivariate analysis demonstrated that infants with exclusive breastfeeding had stunting by 0.5/100 times compared to infants with non-exclusively breast feeding (OR=0.53; p=0.192), but it was statistically not significant. Breastfeeding mothers with abnormal nutritional status had stunting by 3.28/100 times compared to mothers with normal nutritional status (OR=3.28; p=0.006). Inadequate zinc intake in breastfeeding mothers was 0.8/100 times compared to adequate zinc intake (OR=0.83; p=0.913), but it was statistically no significant.

Table (2): Results of bivariate analysis.

Variable	Stunting				Total		OR	P
	Non-Stunting		Stunting		n	%		
Exclusive breastfeeding								
Non-exclusive breastfeeding	14	41.2	20	58.8	34	100	0.53	0.192 NS
Exclusive breastfeeding	32	57.1	24	48.9	56	100		
Maternal nutritional status BMI (kg weight/m^2 height)								
Normal	31	64.6	17	35.4	48	100	3.28	0.006
Not normal	15	35.7	27	64.3	42	100		
Maternal zinc intake (gram)								
Sufficient	9	47.4	10	52.6	19	100	0.83	0.913 NS
Insufficient	37	52.1	34	47.9	71	100		

NS: non-significant

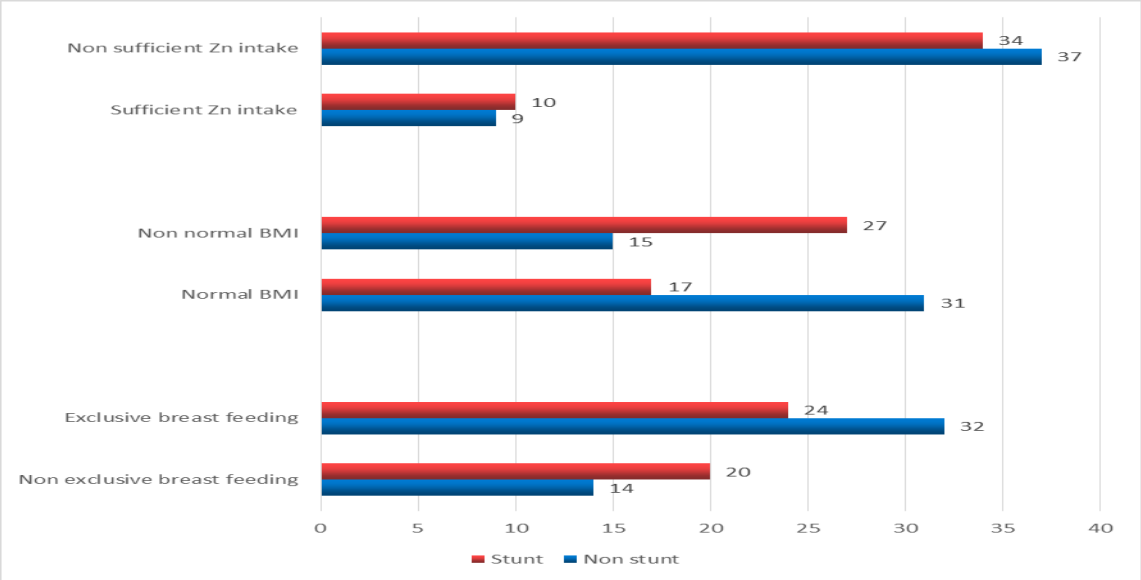

Figure (1): Relation of breast feeding, BMI and zinc intake with infant stunting.

DISCUSSION

Breast milk is the ideal nutrition to support the health, growth and infant development optimally; as a result, it is important to give exclusive breastfeeding for the first 6 months of life (Ferreira et al., 2013).

There is a significant difference between exclusive and non-exclusive breastfeeding with the linear growth of children (Chika et al., 2014). Breastfeeding is stated to be exclusive if children under five only get breast milk without any additional food or drink from birth to aged 6 months (Zogara et al., 2016). Infants who get exclusive breastfeeding have 1.62 times greater chance of getting normal growth (Fitri et al., 2014).

The result of path analysis showed that the association between exclusive breastfeeding and stunting was statistically nonsignificant. However, there was a direct association between exclusive breastfeeding and stunting. Infants with exclusive breastfeeding would have the risk of stunting by 0.5 lower than non-exclusive breastfeeding. This is in line with a study conducted by (Rakhmahayu et al. 2019) that infants who get exclusive breastfeeding have the risk of stunting by 2.04 lower than infants who do not get exclusive breastfeeding. It is supported by (Fitri et al. (2014) that exclusive breastfeeding in the first 6 months can reduce the risk of stunting. Infants with exclusive breastfeeding have the lower risk of stunting by 3.27 times (Abubakar et al., 2010). It is because breast milk contains antibodies and

calcium content. In addition, breast milk also has high bioavailability, so that it can be optimally absorbed, especially in bone formation (Almatsier, 2009).

Besides, there is growth hormone which can increase the growth process of the baby's digestive system and protect the baby against bacteria and viruses (Kismul et al., 2017). Infants who do not exclusively breastfed will have a risk of stunting by 4.9 to 6.54 times. It is associated with the incidence of infectious diseases such as diarrhea that is more commonly occur in infants under 6 months who are given other food besides breast milk. Infectious diseases cause decreased appetite, decreased absorption of nutrients and increased catabolism, so that the nutrients are insufficient to support growth (AL-Rahmad et al., 2013; Lestari et al., 2018).

Based on the result of the study, there was a direct association between nutritional status of breastfeeding mothers and stunting. Infants aged 6 months with breastfeeding mothers with abnormal nutritional status had a higher risk of stunting than normal nutritional status. It is in line with (Kaur and Sen (2017) and Ayuningrum et al. (2017) that maternal nutritional status will affect the nutritional status of the child; therefore, it significantly affects the infant growth.

It is supported by (Rahayu et al. (2018) that infants with mothers who are malnourished have a risk of stunting by 8.87 times higher than mothers with good nutrition. Maternal nutritional status will determine the quantity and quality of dairy products that indirectly play a role in determining the nutritional status of children (Syafiq et al., 2015).

Mothers with underweight nutritional status have a risk of unsuccessful breastfeeding by 2.26-2.56 times compared to breastfeeding mothers with normal nutritional status. Therefore, the unsuccessful exclusive breastfeeding will affect their child's nutritional status (Demissie et al., 2003), according to Irawati et al. (2003).

Zinc is one of the minerals that is very needed by breastfeeding mothers. Breast milk has a very good zinc bioavailability. However, the zinc content decreases after breastfeeding for the first 6 months (Hardinsyah and Supariasa, 2016).

Therefore, the need for zinc increases during breastfeeding compared to during pregnancy. Higher mineral intake in the composition of breast milk can affect the infants' growth and development (Huang, et al, 2016). Zinc intake has an association with the increase of growth hormone (IGF-1) or cell replication and the development of immune responses. As a result, if zinc intake is inadequate, there will be growth disturbance and an increase of the risk of child morbidity (Fallah et al., 2018).

Breastfeeding can reduce maternal weight after giving birth (Bobrow et al. (2013). Breastfeeding can accelerate weight loss after giving birth, but in the ideal limits. Breastfeeding also affects the reduction in body fat percent. Breastfeeding exclusively decreases body fat percent by 2.7 times greater than non-exclusive breastfeeding. Mothers who breastfeed their babies have changes in body composition due to changes in body fat mass (Harsanti and Kusumastuti, 2013).

Mothers who breastfeed exclusively have a reduction in body fat percent in the arms.

Changes in maternal nutritional status as an effect of the pattern of breastfeeding can be seen after giving breast milk for 6 months (Harsanti and Kusumastuti, 2013). It is reported by (Okechukwu et al. (2009) that maternal nutrition has a significant association on exclusive breastfeeding and non-exclusive breastfeeding. The maternal average BMI is 1% lower for every 6 months after breastfeeding, thus reducing the risk of obesity with age (Bobrow et al. (2013).

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