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Mothers' breastfeeding techniques and its correlation to their infants' nutritional status: a study in a rural area

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Informed consent: all respondents signed the informed consent form after the researcher explained that their breastfeeding technique would be observed during the data collection.

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Abstract

Proper breastfeeding techniques are important to maintain adequate breast milk supply. The study aimed to determine the breastfeeding techniques of mothers in rural areas and discover the correlation with the nutritional status of their infants. This research involved 107 mothers with infants aged 0-6 months and data was collected using observation sheets. The Spearman-Rho test was used to analyze the relationship between the breastfeeding technique and the nutritional status of the infants. Most respondents were mothers aged 26 to 35 with high school-level education and daily lives as housewives. Most of the infants were 3 months old (27.1%), female (57.9%), and some of them were macrocephaly (31.8%), underweight (26.2%), stunted (16.9%), and wasted (12.3%). Additionally, most mothers had an inappropriate breastfeeding technique (60.7%) and statistically, there was no correlation with the nutritional status of their infants aged 0-6 months ($\rho>0.05$). The results of this

study require health workers to optimize the nutritional needs of infants in rural areas by providing effective educational strategies on proper breastfeeding techniques, regardless of other factors influencing nutritional status.

Introduction

Adequate nutrition for infants aged 0-6 months is important for their growth, development, and health maintenance.[1] Lack of nutrition can lead to different forms of undernutrition, such as wasted (underweight for body length), stunted (low body length for age), and underweight (underweight for age).[2] Breastfeeding plays a supportive role in providing nutrition for infants aged 0-6 months.[3] Furthermore, proper breastfeeding techniques are related to nutritional balance because proper techniques can maximize breastmilk supply to babies.[4]

World Health Organization (WHO) recommends exclusive breastfeeding from 0-6 months and complementary foods in parallel with breastmilk for up to 2 years.[5] The United Nations Children's Fund (UNICEF) also noted that exclusive breastfeeding of infants under 6 months has reached 48% worldwide, almost reaching the World Health Assembly 2025 target of 50%.[6] This trend has also been observed in Indonesia, which shows a positive trend in the annual percentage of exclusive breastfeeding of infants under six months of age. According to the Directorate of People's Welfare Statistics of Indonesia,[7] the number of infants under six months who breastfed exclusively has reached 73.97%, where the highest percentage is in the province of Central Java (80.2%).

This study focuses on breastfeeding techniques because although the percentage of breastfeeding is high in Indonesia, there are still many stunting and wasting incidents. Improper breastfeeding techniques contribute to poor breastmilk transfer from mothers to their infants, which leads to infants' nutritional deficiencies.[8] Globally, stunting and wasting have affected and threatened an estimated

22.3% and 6.8% of children under five years in 2022, respectively.[9] In 2022, the prevalence of stunting was approximately 21.6% in Indonesia and 20.8% in Central Java Province. Meanwhile, the prevalence of wasting in 2022 was 7.7% in Indonesia and 7.9% in the Central Java province. Although there has been a decrease in stunting rates since 2021, there has also been an increase in wasting rates. Therefore, the problem of malnutrition persists worldwide and locally.

We conducted a preliminary study in May 2023 in several rural villages. The nutritionist of the community health center (*Puskesmas*) said that 77.92% of infants received exclusive breastfeeding but there was still a risk of stunting (12.8%). We found that the main problems influencing exclusive breastfeeding were pain and soreness during breastfeeding. Some breastfeeding mothers said that they do not understand the proper breastfeeding technique. This issue must be corrected, as the mothers must know the correct technique and position when breastfeeding and can practice it when breastfeeding their infants. Therefore, at the end of the data collection process, the researcher taught the correct breastfeeding technique when mothers directly breastfeed their infants. That was a reward or expression of gratitude because of their willingness for their breastfeeding process to be observed. Most mothers in the preliminary study expressed their hope for one-on-one education to increase their knowledge regarding correct breastfeeding techniques. Increasing maternal knowledge was not the main purpose of this study because our need is accurate data related to the breastfeeding steps that are currently still not right so that the preparation of educational interventions can be more effective and appropriate according to the steps that are not right. The breastfeeding technique is considered correct when there is a good attachment between the mother and infant and they show the correct position.[8] Mistakes in breastfeeding techniques can have negative impacts, such as asphyxia (lack of oxygen for the baby),[10] nipple sores, breast swelling, and discomfort for the mother during breastfeeding, which can prevent optimal breastmilk flow and result in nutritional deficiencies in the baby.[11]

This research analyzes the relationship between breastfeeding techniques and nutritional status in infants 0-6 months of age. The specific objectives of this study are to identify the breastfeeding techniques employed by mothers and the nutritional status of infants aged 0-6 months.

Materials and Methods

Ethical considerations

The health research ethics committee at the Nursing Faculty of Sultan Agung Islamic University approved this study with the number 928/A.1-S1/FIK-SA/V/2023. All respondents signed the informed consent form after the researcher explained that their breastfeeding technique would be observed during the data collection.

Subject

Researchers used the entire population of breastfeeding mothers with infants aged 0-6 months in several villages in one district in a health center area. Based on data from the health center, 180 infants were exclusively breastfed, but the data did not match the reality. The inclusion criteria in this study were all breastfeeding mothers with infants aged 0-6 months in the *Puskesmas* area and mothers who could breastfeed and were willing to be respondents by signing a consent form. The exclusion criteria for this study were sick infants (may cry or be fussy when breastfed), infants using pacifiers, and breastfeeding mothers who were ill and may not be able to breastfeed their infants optimally. This research used purposive sampling, and 107 infants met the inclusion criteria. This study was carried out in a *Puskesmas* in a rural area from March to December 2023.

Data collection

This research used a cross-sectional quantitative correlation approach to determine the relationship between the variables. The instrument used to collect information regarding correct breastfeeding

techniques was an observational form, and the nutritional status instrument used was an observation sheet consisting of the baby's weight, body length, and head circumference. Infant weight measurement used a weight scale that has been calibrated, while a flexible tape measure was used to measure body length and head circumference. Researchers used the same tool for all infants.

Data were collected by watching mothers breastfeed their infants and assessing them using a form. Researchers also measured the infant's weight, body length, and head circumference to determine the nutritional status. The data collection was assisted by an observer which has previously been explained about this study so that they have the same perception as the researcher. The observer was a sixth-grade female nursing student who passed an anthropometry skill examination. The implementation stages were as follows: i) the researchers visited the respondents at their homes and provided them with a consent form to become respondents (informed consent), ii) the researchers asked the respondents to conduct their breastfeeding habits regarding position, sucking, and attachment for their infants (one-day observation), iii) the observer looked and checked the respondent's accuracy when breastfeeding. After that, the researcher assisted by the observer measured the infants' body weight, body length, and head circumference, then looked at their nutritional status using a growth table. The researchers then checked the completeness of the data collected. Finally, the researchers gave rewards to the respondents.

Data analysis

The univariate analysis in this study described the correct breastfeeding steps, breastfeeding position, and breastfeeding attachment. Data that describe the correct breastfeeding techniques with nutritional status in categorical form were analyzed using proportion analysis and expressed in a frequency distribution table. Bivariate analysis in this study was carried out to determine the correlation between breastfeeding techniques and nutritional status in babies aged 0 to 6 months. The Spearman's Rho test was used in this research because the type of data was on a nominal-ordinal scale. We used an

observational sheet of the breastfeeding technique from IDAI (2013) to analyze the techniques and separate them into proper and improper. Researchers observed mothers while breastfeeding their babies and matched them with the observation sheet: if the mother breastfeeds correctly according to the observation sheet, then it is called the correct breastfeeding technique. Conversely, if there is at least one error or discrepancy with the observation sheet, then it is stated that the breastfeeding technique is incorrect. Furthermore, the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Child Anthropometry Standards was used to assess the nutritional status of infants. Measurement of nutritional status is based on body weight and length parameters,[12] researchers use three indices, including Weight-For-Age (WAZ), Length/Height-For-Age (HAZ), and Weight-For-Length/Height (WHZ). The determination of categories is based on the threshold values in the regulation (Z-score) (Table 1).

Results

The results of this study show the characteristics of the respondents and their infants (Table 2), mothers' breastfeeding technique (Table 3), and the relationship between mothers' breastfeeding technique and their infants' nutritional status aged 0-6 months (Table 4).

The results presented in Table 2 show that most of the respondents were 26-35 years old (59.8%), had senior high school degrees (64.5%), and were housewives (67.3%). Meanwhile, most of the infants were 3 months old (27.1%), female (57.9%), and had a normal head circumference (66.4%). The results also revealed that some of the infants were underweight (23.4%), stunted (14.0%) and wasted (10.3%). Some infants had abnormal head circumference (33.7%) and most of the mothers' breastfeeding techniques were improper (60.7%).

Table 3 below lists the characteristics of mothers during the breastfeeding process.

Table 3 reports that most mothers did not wash their hands before starting breastfeeding (52.3%), did not try to release the infant's suction with their little fingers (44.9%) so that the infants suckled the

breast until they released on their own, and did not provide stimulation to the baby before starting breastfeeding (40.2%) because mothers assume that the infants looked thirsty. In addition, some mothers did not ensure that the infant's lower lip was curled out (3.7%), the infant's mouth was wide open (0.9%), and did not lubricate the nipple with breastmilk (0.9%).

Table 4 below shows the analyzing results of Spearman's Rho test.

Table 4 shows no significant relationship between the breastfeeding technique and the infant's nutritional status. In addition, Kendall's tau-b result shows no significant relationship between the characteristics of the respondents and the breastfeeding technique. Meanwhile, the Contingency coefficient test results show a weak positive correlation between mothers' occupation and breastfeeding techniques, which means that housewives tend to do more proper breastfeeding techniques but the relationship is not very strong.

Discussion

Maternal and infant characteristics related to mothers' breastfeeding technique

The first maternal characteristic is age, which is often related to a person's experience: the older a person gets, the more knowledge and information they obtain from external and internal sources.[13,14] In this study, most mothers were in the young adulthood category (26-35 years), characterized by independence and problem-solving.[15,16] However, we found that most of the mothers practiced improper breastfeeding techniques, proven by ineffective infant suckles because they breastfeed according to what they understand and see from their surroundings. This finding indicates that mothers need education on breastfeeding techniques. Furthermore, most of the respondents who practiced improper breastfeeding techniques had a senior high school education. Education is a developmental process that improves skills. Mothers with higher education levels may find it easier to care for their children, especially regarding the precision and attention required to provide adequate nutrition, including exclusive breastfeeding.[17,18] In addition, knowledge will provide mothers with an

understanding of the benefits and importance of their children's nutritional needs.[19] However, based on our findings, the level of education may not always determine sufficient knowledge about breastfeeding techniques because it is a specific knowledge that needs skills and support from health workers and their families.[20]

Then, most of the respondents were housewives and the number of those who practiced proper *versus* improper breastfeeding techniques was the same. High work activity, either being a full-time housewife or working mothers at the office, can make women pay less attention to the information around them.[21] A previous study found that the children of mothers who are full-time housewives have a higher chance of experiencing stunting.[22] However, exclusive breastfeeding practice was higher among housewives compared with working mothers.[23] Our findings show a weak positive correlation between housewives and correct breastfeeding techniques. This shows the importance of a mother being at home, especially until completing exclusive breastfeeding. Indonesian government through the House of Representatives supports the exclusive breastfeeding program by passing the Maternal and Child Welfare Bill which regulates working mothers entitled to maternity leave for up to 6 months.[23,24] Furthermore, health workers need to play an active role in providing education on correct breastfeeding techniques noting that improper breastfeeding techniques in this study were very likely caused by mothers not receiving information. Education programs can be added to discharge planning or provided regularly as an independent nursing intervention in maternity wards, *Puskesmas,* or the community.

Most of the infants in this study were three months old and still showed improper positioning and attachment during breastfeeding. Three-months infants can already hold their heads parallel to their bodies and ideally can attach properly when breastfeeding compared to infants aged 1-2 months.[25] Meanwhile, babies older than 3 months are in the growth spurt phase, where they are often fussy, which affects the mother's breastfeeding technique because the infants suckle according to their comfort.[26] Mothers are generally anxious when facing a fussy baby, so they may breastfeed without

thinking of proper attachment during breastfeeding.[27] Furthermore, most of the infants in this study were female. Naturally, both female and male infants have the ability and instinct to breastfeed although the male infants need more energy[28] and have a higher risk of stunting[29] than female infants. Male infants have very different amounts in growth speed[30] but the problems in breastfeeding are not always related to gender because each infant is unique and has different characteristics. Instead, breastfeeding problems can be caused by infants' health factors or mothers' experiences.

Another indicator for assessing the infants' nutritional status is head circumference.[31] The study result showed that an infant experienced microcephaly and around a third of the total infants experienced macrocephaly and were breastfed improperly. Routine monitoring of changes in head circumference can help identify nutritional problems or suboptimal development in infants.[32] The head circumference of infants gives an idea of the brain's growth.[3] In the case of this study, it is possible that the head circumference of infants with microcephaly was caused by other factors, such as disease or concomitant conditions, such as neurological diseases, genetics, birth conditions, syndromes, and possible developmental disorders.[33] Macrocephaly may be caused by genetic factors, which is commonly caused by poor appetite.[34] Poor appetite leads the infants to difficulty gaining weight, called 'failure to thrive', and sometimes can be associated with brain issues.

Overview of mothers' breastfeeding techniques

In this study, mothers often miss washing their hands before breastfeeding, whereas washing hands with soap and water is the most affordable and effective way to stop the spread of infection.[36] Another step in breastfeeding that was mostly missed by mothers in this study was releasing infants' sucking. A study said that it is unnecessary to release the infant's sucking because they will spontaneously release the nipple.[37] However, if breastfeeding lasts too long (more than half an hour) or too short (less than 4 minutes), this may indicate a problem with attachment.[38] Releasing the baby's sucking at the best time and good steps[39] may be needed before mothers fall asleep to avoid the risk of the

baby choking.[40] Another skipped breastfeeding technique by mothers in this study was not stimulating the sucking reflex. Sucking reflex stimulation can make infants easier in finding the nipple, reduce fussiness, and create comfort during breastfeeding that will disappear at six months of age.[41]

Proper breastfeeding techniques, including correct position and good attachment, are the keys to successful breastfeeding so that nutrient transfer to infants can be optimal.[8] Effective positioning and latching help the infant to suck effectively, maintain mothers' breastmilk production; and prevent breastfeeding problems, such as sore nipples, mastitis, or low breastmilk supply. However, the results of this study show that proper breastfeeding techniques practiced by some mother did not significantly impact their infants' nutritional status. The nutritional status of infants in this study may influenced by other factors such as genetics, the health status of the infants, the caring experience of mothers, and the parents' culture.[39,40]

The correlation between mothers' breastfeeding technique and their infants' nutritional status aged 0-6 months

This research found that the nutritional status of infants aged 0-6 months varied: some had low weight for age index and some were risk overweight. Based on body length measurements, some infants experienced severely stunted or abnormal body lengths. The weight for length index of some infants varied: some were severely wasted and some were obese. The results of the Spearman's Rho test showed a p-value>0.05, which indicates that the correlation between mothers' breastfeeding technique and infants' nutritional status is insignificant. Therefore, we further explained the results of this study based on cross-tabulation analysis.

Based on the weight for age index, despite most infants being in the normal category, they received improper breastfeeding techniques from their mothers. The researchers argued that the infant's weight was normal because the mothers persevered with breastfeeding, even though they felt pain due to poor attachment during breastfeeding. The cross-tabulation analysis showed that some mothers who

practiced proper breastfeeding techniques still had an underweight or risk of overweight infants. This incidence may be caused by other factors, such as genetics, birth history (abnormal or premature), and growth hormone problems.[41] When comparing each data of abnormal weight for age index, most infants were underweight and experienced ineffective breastfeeding techniques. Therefore, although statistically insignificant, improving breastfeeding skills is still important.

The following characteristic of infants' nutritional status is the length for age index. Infants will experience an increase in body length of around 1.5 to 2.5 cm every month from birth to 6 months.[42-46] Breastfeeding can optimize infant growth and development through the rich nutrients in breast milk, such as protein.[4] The results showed that most infants had normal body length and statistically no significant relationship with mothers' breastfeeding technique. Clinically, the cross-tabulation analysis revealed that most infants that had an abnormal body length were experienced stunted and their mothers used improper breastfeeding techniques. It is still important to increase breastfeeding skills even though other factors may influence less optimal growth which triggers abnormalities in the length of the infants' body, such as maternal factors, gender, health insurance ownership, or use of blood supplement tablets.[42,43]

Based on the weight for length index, most infants were normal and some were abnormal (wasted). This finding showed the importance of proper breastfeeding techniques despite this study result showing a statistically insignificant between infants' weight for length index and mothers' breastfeeding techniques. From this research, we conclude that errors in breastfeeding techniques alone did not cause inadequate nutrition in infants because the cross-tabulation results found that some infants from mothers who practiced proper breastfeeding techniques had a lack of adequate nutrition. Meanwhile, infants of mothers who practiced improper breastfeeding techniques still have a normal weight. Uninterrupted breastfeeding can fulfill the infants' nutritional needs through incoming breast milk even if the mother practices ineffective breastfeeding techniques.[47-49] The respondents stated that they would continue to breastfeed their infants even if they felt pain to fulfill

their infants' nutrition needs. Therefore, adequate nutrition of infants whose mothers practiced improper breastfeeding techniques might come from incoming and continuous breast milk (Figure 1).[50]

The researchers recognized several limitations to this study. First, 73 respondents should be excluded because the infants' age was more than 6 months at data collection. Second, some potential respondents rejected to participate in this study because the data collection schedule coincided with work hours. Third, this study needs more details and better control of all variables that could influence infants' nutritional status, such as genetics, infant health factors, and maternal factors (parity status and previous breastfeeding experiences).

Conclusions

This study observed common mistakes among mothers when breastfeeding their infants, including missing washing hands, not lubricating the nipples with breastmilk, missing rooting reflex stimulation before breastfeeding the infants, and not releasing infants' sucking with a finger. Although the mothers practiced improper breastfeeding techniques, their infant's nutritional needs were still met. However, other factors, such as genetics, environment, or birth history may cause nutritional problems in infants whose mothers practiced improper breastfeeding techniques. There is no relationship between mothers' breastfeeding technique and their infants' nutritional status, but clinically, proper breastfeeding technique is needed for successful breastfeeding and to ensure the infants' adequate nutrition. Mothers can optimally practice effective breastfeeding techniques if they and their support systems (husband and family) are provided with education or counseling sessions by health workers. Mothers can also participate in group discussions to share knowledge and experiences as a form of caring for fellow breastfeeding mothers.

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Table 1. Categories and thresholds of children's nutritional status.

Index	**Category**	**Threshold (Z-Score)**
Weight-for-Age (WAZ)	Severely underweight	< -3 SD
	Underweight	-3 SD < -2 SD
	Normal	-2 SD +1 SD
	Risk of overweight	>+1 SD
Length/Height-for-Age (HAZ)	Severely stunted	< -3 SD
	Stunted	-3 SD < -2 SD
	Normal	-2 SD +3 SD
	Tallness	>+3 SD
Weight-for-Length/Height (WHZ)	Severely wasted	< -3 SD
	Wasted	-3 SD < -2 SD
	Normal	-2 SD +1 SD
	Possible risk of overweight	>+1 SD +2 SD
	Overweight	>+2 SD +3 SD
	Obese	>+ 3 SD

SD, Standard Deviation

Table 2. Respondent characteristics and the results of their breastfeeding techniques (n=107).

Characteristics	Breastfeeding techniques		Frequency n (%)	ρ value
	Improper n (%)	Proper n (%)		
Mother's age				
17-25	23 (21.5)	13 (12.1)	36(33.6)	0.821**
26-35	37 (34.6)	27 (25.2)	64(59.8)	
36-45	5 (4.7)	2 (1.9)	7(6.5)	
Mother's education				
Elementary school	8 (7.5)	1 (0.9)	9(8.4)	0.399**
Junior high school	16 (15)	12 (11.2)	28(26.2)	
Senior high school	40 (37.4)	29 (27.1)	69(64.5)	
College	1 (0.9)	0 (0)	1(0.9)	
Mothers' occupation				
Working mothers	29 (27.1)	6 (5.6)	35(32.7)	**0.001***
Housewives	36 (33.6)	36 (33.6)	72(67.3)	**(r=0.30)**
Infant's age				
1 month	14 (13.1)	8 (7.5)	22(20.6)	0.747**
2 months	10 (9.3)	6 (5.6)	16(15.0)	
3 months	16 (15.0)	13 (12.1)	29(27.1)	
4 months	14 (13.1)	6 (5.6)	20(18.7)	
5 months	11 (10.3)	7 (6.5)	18(16.8)	
6 months	0 (0.0)	2 (1.9)	2(1.9)	
Infant's gender				
Female	38 (35.5)	24 (22.4)	62(57.9)	0.893*
Male	27 (25.2)	18 (39.3)	45(42.1)	
Infant's head circumference				
Microcephaly	1 (1.5)	1 (2.4)	2(1.9)	
Normal	42 (64.6)	29 (69.0)	71(66.4)	0.545***
Macrocephaly	22 (33.8)	12 (28.6)	34(31.8)	

*Contingency coefficient test; **Kendall's tau-b test

Table 3. The characteristics of mothers' breastfeeding techniques (n=107).

Steps to breastfeeding	**Not done n (%)**	**Done n (%)**
Washing hands with soap and water	56 (52.3)	51 (47.7)
Lubricating nipples with breastmilk	1 (0.9)	106 (99.1)
Position baby "tummy to tummy"	0 (0.0)	107 (100.0)
Putting the thumb on the top of the breast and cup other fingers around the bottom of the breast (C-hold)	0 (0.0)	107 (100.0)
Triggering the rooting reflex by gently stroking the infant's cheek with the nipple	43 (40.2)	64 (59.8)
Make sure the infant's mouth is wide open before the nipple enters	1 (0.9)	106 (99.1)
Bringing the infant's head closer to the breast after a wide-open mouth	0 (0.0)	107 (100.0)
Make sure a large portion of the lower areola into the infant's mouth	0 (0.0)	107 (100.0)
Make sure the infant's lower lip curled out	4 (3.7)	103 (96.3)
Making sure the infant's chin firmly touches the breast	0 (0.0)	107 (100.0)
Releasing the infant's sucking with the mother's little finger	48 (44.9)	59 (55.1)

Table 4. The correlation between breastfeeding technique and nutritional status in infants aged 0-6 months (n=107).

Characteristics of infants' nutritional status	**Breastfeeding techniques**		**Frequency n (%)**	**ρ value**
	Improper n (%)	**Proper n (%)**		
Weight-for-age index				
Underweight	17 (26.2)	8 (19.0)	25 (23.4)	0.402***
Normal	43 (66.2)	30 (71.4)	73 (68.2)	
Risk of overweight	5 (7.7)	4 (9.5)	9 (8.4)	
Length/height-for-age index				
Severely stunted	3 (4.6)	1 (2.4)	4 (3.7)	0.467***
Stunted	11 (16.9)	4 (9.5)	15 (14.0)	
Normal	47 (72.3)	36 (85.7)	83 (77.6)	
Tallness	4 (6.2)	1 (2.4)	5 (4.7)	
Weight-for-length/height index				
Severely wasted	4 (6.2)	2 (4.8)	6 (5.6)	0.181***
Wasted	8 (12.3)	3 (7.1)	11 (10.3)	
Normal	46 (70.8)	29 (69.0)	75 (70.1)	
Possible risk of overweight	4 (6.2)	5 (11.9)	9 (8.4)	
Overweight	1 (1.5)	0 (0.0)	1 (0.9)	
Obese	2 (3.1)	3 (7.1)	5 (4.7)	

***Spearman's Rho test

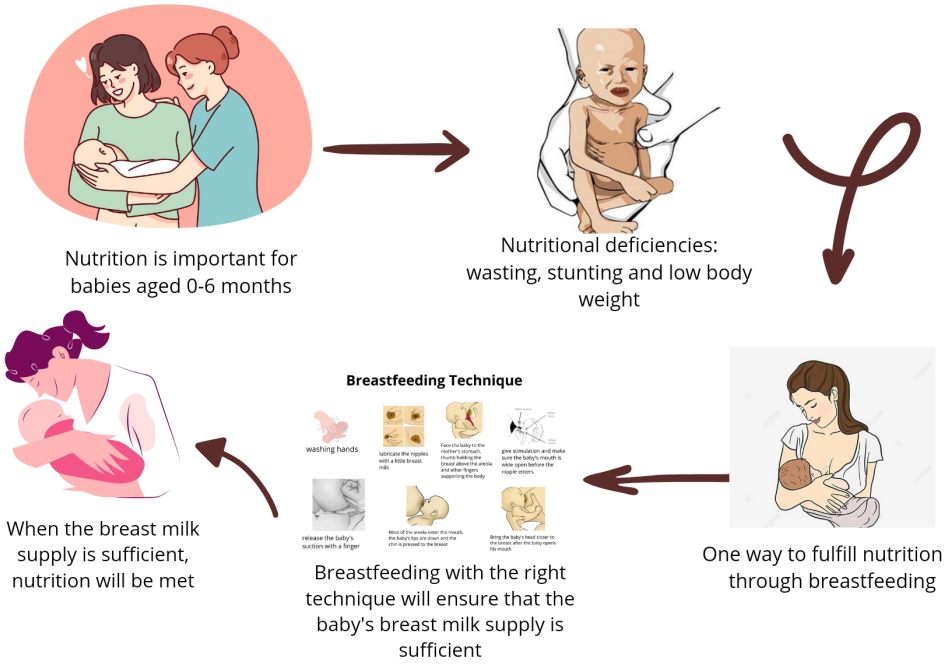

Figure 1. The graphical of the finding.