

# Public Health

## THE PRACTICE OF EXCLUSIVE BREASTFEEDING BY REGION IN INDONESIA

--Manuscript Draft--

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<b>Abstract:</b>	<p><b>Objective :</b> Exclusive breastfeeding has important benefits for both children and mothers. However, the proportion of exclusive breastfeeding is still not evenly distributed between regions, including in Indonesia. The purpose of this study was to analyze the practice of exclusive breastfeeding by region in Indonesia and the factors that influence it.</p> <p><b>Study Design:</b> This study was cross sectional study .</p> <p><b>Methods :</b> This study used secondary data from the Indonesia Demographic and Health Survey 2017. The total sample included was 1,621 respondents which consisted of mothers whose last child was under six months old and still alive, did not have twins, and lived with their child. Data were analyzed using Quantum GIS and binary logistic regression statistical tests.</p> <p><b>Results:</b> This study shows that 51.6% of respondents gave exclusive breastfeeding in Indonesia. The highest proportion was in the Nusa Tenggara region (72.3%), while the lowest was in the Kalimantan region (37.5%). Mothers who lived in the regions of Nusa Tenggara, Sulawesi, Java-Bali, and Sumatra had a higher chance of exclusive breastfeeding compared to mothers in the Kalimantan region. The factors associated with exclusive breastfeeding vary widely across all regions, with the child's age being the only common factor associated with exclusive breastfeeding in all regions, except Kalimantan.</p> <p><b>Conclusion:</b> This study shows wide variation in regional proportions and determinants of exclusive breastfeeding in Indonesia. Appropriate policies and strategies are needed to increase more equitable exclusive breastfeeding practices across all regions in Indonesia.</p>
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## **THE PRACTICE OF EXCLUSIVE BREASTFEEDING BY REGION IN INDONESIA**

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Faculty of Public Health, Sriwijaya University, South Sumatera, Indonesia  
Palembang, September 27, 2022

Dear Editor in chief of Journal of Public Health

We kindly ask for consideration of our manuscript entitled: "The Practice of Exclusive Breastfeeding by Region in Indonesia".

The purpose of this study was to analyze the practice of exclusive breastfeeding by region in Indonesia and the factors that influence it. We used secondary data from the Indonesia Demographic and Health Survey 2017. We found that 51.6% of respondents gave exclusive breastfeeding in Indonesia. This study also shows wide variation in regional proportions and determinants of exclusive breastfeeding in Indonesia. Appropriate policies and strategies are needed to increase more equitable exclusive breastfeeding practices across all regions in Indonesia.

Several previous studies in Indonesia have revealed the scope and determinants of exclusive breastfeeding. However, given the wide geographical, sociodemographic, and cultural diversity in Indonesia, it is important to study exclusive breastfeeding by region. This study can complete the big picture of the exclusive breastfeeding phenomena in Indonesia, which can then be taken into consideration in resolving the gap in exclusive breastfeeding in Indonesia.

The information presented about the practice of exclusive breastfeeding by region in Indonesia would be valuable for public health. The article is of high importance for a readership interested in health behaviour, including policy makers and public health workers.

With the submission of this manuscript, we certify that this manuscript has neither been previously published, and we certify that the script is an original work. We confirm that all authors have disclosed any actual or potential competing interests regarding the submitted article and the nature of those interests. We hope that our manuscript is suitable for publication in journal of public health in special issue.

We look forward to hearing from you.

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## TABLE OF RESPONSES TO REVIEWER(S)' COMMENTS

Dear editor & reviewer

Thank you for valuable comments. We really appreciate all comment for improvement our paper. Here below our response.

### Editor comment:

Could you please revise based on the reviewer's feedback below, and also could you please ask a native English speaker to check the article for language issues.

Response:

Thank you for the advise. We have proofread our manuscript

NO	REVIEWER COMMENTS	RESPONSES TO COMMENTS
1.	Lines 17-21: It says here that the % of exclusively breastfed children increased by 11% between 2012 and 2017, from 42% to 52%. This is a 10% increase, not 11%. Please also clarify that means the initiation of exclusive breastfeeding at birth. It also says that the % of children not exclusively breastfed increased from 11% to 12% in the same period - are you referring to partial/combo feeding here?	Thank you for the correction. We have revised our statement that "the coverage of exclusive breastfeeding for children under six months old increased by 10% in the last 5 years, from 42% in 2012 to 52% in 2017" See line 11-12 Exclusive breastfeeding is the process of feeding infants during the first 1 hour after giving birth. See line 15-16 the % of children not exclusively breastfed increased from 11% to 12% in the same period refers to children who did not get breast milk at all
2.	Line 23: To acknowledge the achievement of 50% exclusive breastfeeding initiation at birth, you could expand a little more. Were there any notable social developments during this time that contributed to the success of the strategy?	We have added information about some regulations implemented support exclusive breastfeeding in Indonesia See line 18-19
3.	Line 52: Is there a word missing after "development"?	We have erased the word "development"
4.	Methods Lines 15-20: Can you clarify the % of mothers excluded from the study by category, e.g. 30% excluded due to incomplete data, 5% due to twins, etc.	We have added the information about 10% was excluded due to incomplete data, 1% was due to twins and 1% was the missing data.  See line 64-65

5.	Results Line 5: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See line 131
6.	Table 1: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See table 1
7.	Table 3: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See table 3
8	Discussion Line 4: Change the word "proves". It's a cross-sectional study - causation cannot be determined.	We have revised our statement to this study reported that certain regions have diverse socio-economic, religious, cultural, and geographical conditions.
9	Lines 29-30: The statement that working mothers struggle to balance work and family life is not referenced. It could also be argued that the balance currently achieved - where women breastfeed for as long as possible while also working to provide an income for themselves and their other children - is the best balance that can be currently achieved.	We have added this information See line 70-72
10	Line 20: You mention "danger signs". Are these the factors that increase the risk of low supply?	Yes, it might be caused by one of factor from increase the risk of low supply See line 111-112

## THE PRACTICE OF EXCLUSIVE BREASTFEEDING BY REGION IN INDONESIA

### ABSTRACT

*Objective:* Exclusive breastfeeding has important benefits for both children and mothers. However, the proportion of exclusive breastfeeding is still not evenly distributed among regions, including in Indonesia. The purpose of this study was to analyze the practice of exclusive breastfeeding by region in Indonesia and its influencing factors.

*Study Design:* This study was cross sectional study.

*Methods:* This study used secondary data from the Indonesia Demographic and Health Survey 2017. The total sample was 1,621 respondents which consisted of mothers whose last child was under six months old and was still alive; the mothers did not have twins and lived with their child. Data were analyzed by using Quantum GIS and binary logistic regression statistical tests.

*Results:* This study shows that 51.6% of respondents gave exclusive breastfeeding in Indonesia. The highest proportion was in Nusa Tenggara region (72.3%), while the lowest was in Kalimantan province (37.5%). Mothers who lived in the regions of Nusa Tenggara, Sulawesi, Java-Bali, and Sumatra had a higher chance of exclusive breastfeeding compared to those of in Kalimantan region. The factors associated with the exclusive breastfeeding vary widely across all regions, and the child's age is the only common factor associated with the exclusive breastfeeding in all regions, except Kalimantan.

*Conclusion:* This study shows wide variation in regional proportions and determinants of exclusive breastfeeding in Indonesia. Therefore, appropriate policies and strategies are needed to increase equitable exclusive breastfeeding practices across all regions in Indonesia.

**Keywords:** Exclusive breastfeeding, regions, Indonesia, logistics, binary

1       1     **INTRODUCTION**

2       2             Breast milk (ASI) contains nutrients that are essential for the health, growth, and  
3       3     development of a baby [1]. Breastfeeding is one of the public health interventions to reduce the  
4       4     baby mortality, [2] the baby's risk of contracting digestive diseases, respiratory infections, and  
5       5     obesity. On the other hand, the exclusive breastfeeding can improve children's cognitive abilities  
6       6     [3–5] and contribute to prevent mothers from the risk of developing breast and ovarian cancer and  
7       7     to reduce the risk of obesity and chronic diseases such as type II diabetes mellitus [6]. In Indonesia,  
8       8     the infant mortality rate was 21 per 1,000 live births in 2018, higher than other developing South-  
9       9     East Asian countries, such as Vietnam (16 per 1,000 live births), Thailand (8 per 1,000 live births),  
10      10     and Malaysia (7 per 1,000 live births) [7]. According to the Indonesia Demographic and Health  
11      11     Survey 2017, the coverage of exclusive breastfeeding for children under six months old increased  
12      12     by 10% in the last 5 years, from 42% in 2012 to 52% in 2017. It shows that 48% of children under  
13      13     six months old across Indonesia were not exclusively breastfed. The percentage of children who  
14      14     did not get breast milk at all increased from 8% in the Indonesia Demographic and Health Survey  
15      15     2012 to 12% in the Indonesia Demographic and Health Survey 2017 [8]. Exclusive breastfeeding is  
16      16     the process of feeding infants during the first 1 hour after giving birth.

17      17             The achievement of exclusive breastfeeding in Indonesia has met the minimum target of  
18      18     50% set in the national development plan for the last five years. Some regulations implemented  
19      19     support exclusive breastfeeding in Indonesia. However, the proportion of exclusive breastfeeding  
20      20     decreases as the children get older. The proportion of children receiving exclusive breastfeeding  
21      21     varies. Around 67% were children aged under one month, 55% were aged 2-3 months, and 38%  
22      22     were aged 4-5 months [8]. The proportion of exclusive breastfeeding in Indonesia is still not evenly  
23      23     distributed among provinces and even gaps exist among them. The five provinces with the highest  
24      24     rates of exclusive breastfeeding were West Nusa Tenggara, East Kalimantan, East Java, the Special  
25      25     Region of Yogyakarta, and East Nusa Tenggara, whilst other five lowest-achievement provinces  
26      26     were North Sumatra, Gorontalo, Maluku, Papua, and West Papua [9].

27      27             Several previous studies in Indonesia have revealed the scope and determinants of  
28      28     exclusive breastfeeding. A national study based on an analysis of the Indonesia Demographic  
29      29     and Health Survey from 2002 to 2017 showed that the proportion of mothers who exclusively  
30      30     breastfed their babies increased significantly between 2002 and 2017, with a greater increase  
31      31     among mothers from the higher wealth quintiles, working in professional sectors, and living in  
32      32     Java and Bali [10]. In general, the factors linked to the exclusive breastfeeding include the child's  
33      33     age, mother's education, occupation, type of delivery, parity, economic status, residence, and  
34      34     early initiation of breastfeeding [11–14]. In addition to the wide geographical,  
35      35     sociodemographic, and cultural diversity in Indonesia, it is important to study exclusive  
36      36     breastfeeding by region. To illustrate, eastern Indonesian socio-economic developments such as  
37      37     industry, housing, public transportation, road facilities, and health facilities are slower than those  
38      38     in western Indonesia, especially in Java region [15–18]. Therefore, this study aims to analyze the  
39      39     practice of exclusive breastfeeding by region in Indonesia using nationally representative data  
40      40     from the Indonesia Demographic and Health Survey 2017. This study can complete the big  
41      41     picture of the exclusive breastfeeding phenomena in Indonesia which can resolve the Indonesian  
42      42     exclusive breastfeeding. The purpose of this study is to analyze the practice of exclusive  
43      43     breastfeeding by region in Indonesia and factors that influence it.

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## 48 **METHODS**

### 50 **Data Source**

51 This study performed secondary data analysis. Data were taken from the Indonesia  
52 Demographic and Health Survey (IDHS) 2017. IDHS is part of the International Demographic and  
53 Health Survey (DHS) program organized by the Inner-City Fund (ICF) to provide a comprehensive  
54 picture of the population as well as maternal and child health in Indonesia. The sample from IDHS  
55 2017 was designed to present national and provincial estimates. It covered 1,970 census blocks  
56 covering both urban and rural areas.

57 This survey used a two-stage stratified cluster sampling method. The first stage was the  
58 selection of several census blocks using a systematic probability proportional to measure (PPS) the  
59 number of households obtained from the SP2010 listing. The second stage selected 25 ordinary  
60 households using systematic sampling from the list. The population of this study was 49,692  
61 Indonesian women of childbearing age (15-49 years) - data was from the 2017 IDHS. The sample  
62 used in this study was part of the population with some inclusion criteria, namely mothers whose  
63 last child was under six months old and still alive, they did not have twins and lived with their  
64 child. 10% was excluded due to incomplete data, 1% was due to twins and 1% was the missing  
65 data. Finally, the samples of this study were 1,621 altogether. The mothers with incomplete data  
66 were not included in the analysis [8].

### 68 **Result Variables**

69 The proportion of exclusive breastfeeding refers to infants under six months old who receive  
70 not only breast milk as their source of food, but also oral rehydration solutions, vitamin drops or  
71 syrup, and medications). The data were collected from the mother's memory of the food given to  
72 her baby in the last 24 hours prior to the survey and it is in line with the WHO/UNICEF guidelines  
73 to assess the feeding practices to infants and children [19]. Result variables were defined in binary  
74 categories, exclusive breastfeeding and unexclusive breastfeeding.

### 76 **Research Factor**

77 Research factors were adapted from previous studies [11,13,14]. These included predisposing  
78 factors and enabling factors. Predisposing factors include maternal age, child age, education,  
79 employment status, economic status, residence, parity, and early initiation of breastfeeding.  
80 Enabling factors include the number of antenatal care visits, place of delivery, type of delivery, and  
81 a number of postnatal care visits.

82 Maternal age was divided into three age groups, namely 15-19 years, 20-34 years, and 35-49  
83 years. Children's age was divided into three age groups, all of which are 0-1 month, 2-3 months and  
84 4-5 months, and mother's education was divided into three groups; low (no school or elementary  
85 school graduates), middle (secondary school graduates), and higher (college graduates). Mother's  
86 occupation was divided into employed (e.g., professional, technician, manager and administration,  
87 clerk, sales, service, agricultural or industrial worker) and non-employed. Residence was divided  
88 into rural and urban. Using the wealth index, economic status in this study was classified into three  
89 groups, namely poor (poor and poorest), middle, and rich (rich and richest). Parity referred to the  
90 number of children born to the mothers and was categorized into 1 and >1. The number of antenatal  
91 care visits made by the mothers during pregnancy was categorized into  $\geq 4$  and  $< 4$ . Place of  
92 delivery was categorized into health facilities and non-health facilities. The type of delivery was  
93 categorized into vaginal delivery and cesarean section. Early initiation of breastfeeding was divided



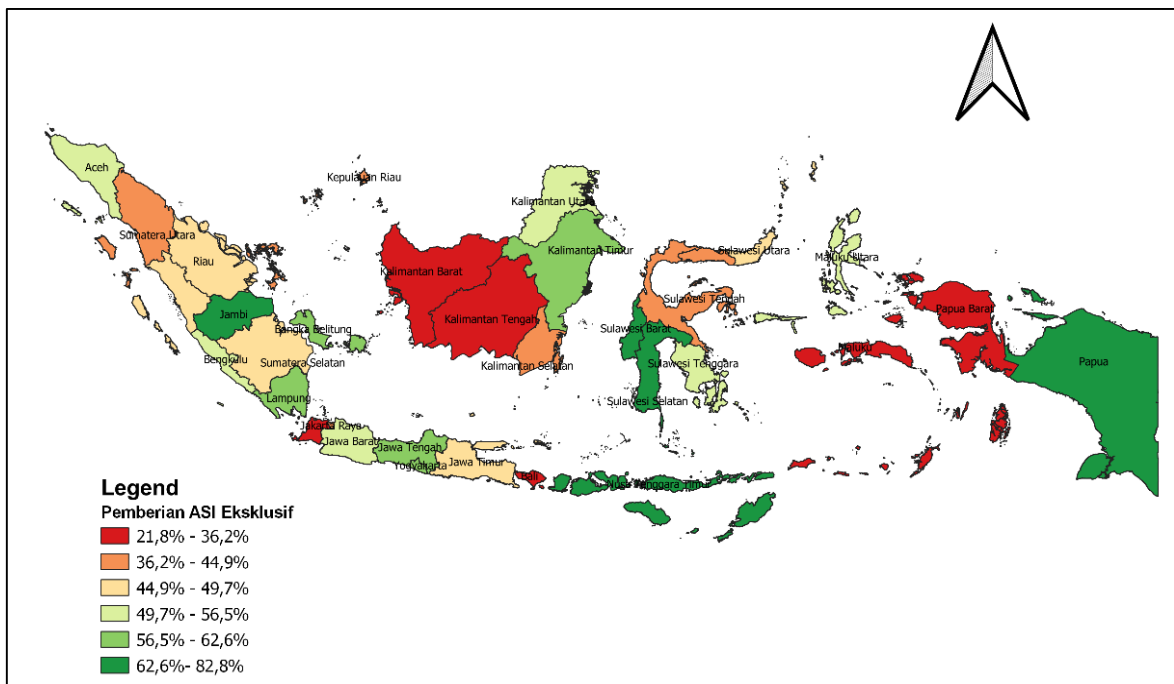
1 94 into two categories, namely  $\leq 1$  hour and  $> 1$  hour. Postnatal care visits referred to children who  
2 95 were examined at a health facility in the first two months after birth.  
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### 5 97 **Data Analysis**

6 98 Data analysis was done by regions grouped based on the largest islands, namely Sumatra,  
7 99 Java-Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku Islands, and Papua [18,20]. Sample  
8  
9 100 weights were used to analyze the data from the IDHS. All data were analyzed with a complex  
10 101 sample design. Statistical analyses i.e., univariate analysis and bivariate analysis were performed  
11 102 through binary logistic regression. The relationship between the independent and dependent  
12 103 variables was classified based on the p-value of the binary logistic regression test results, with  $p <$   
13 104  $0.05$  for statistically significant relationships. The direction of the relationship between the  
14 105 independent and dependent variables was seen based on the odd ratio value of the binary logistic  
15 106 regression test results, with a reference value of 1. Meanwhile, a spatial analysis was to find out the  
16 107 distribution map of exclusive breastfeeding by province in Indonesia. The analysis used the  
17 108 Statistical Product and Service Solutions (SPSS) software and Quantum GIS.  
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19 109

### 20 110 **RESULTS**

21 111 Figure 1 shows the distribution of exclusive breastfeeding in 34 provinces of Indonesia.  
22 112 Kalimantan region (West Kalimantan and Central Kalimantan), Maluku Island region (Maluku),  
23 113 and Papua region (West Papua) had the lowest distribution of exclusive breastfeeding. Meanwhile,  
24 114 the highest distribution of exclusive breastfeeding was in Nusa Tenggara region.  
25  
26 115



116  
117 **Figure 1. Distribution of Exclusive Breastfeeding by Province in Indonesia**

### 118 **Respondents Characteristics**

119 Table 1 shows that the proportion of mothers who give exclusive breastfeeding in Indonesia is  
120 51.6%. The highest proportion of exclusive breastfeeding was in the Nusa Tenggara region (72.3%)  
121 and the lowest was in the Kalimantan region (37.5%). The majority of mothers were in the age  
122 group of 20-34 years. The majority of children were in the age group of 2-3 months and 4-5  
123 months. The Java-Bali region was dominated by women who lived in urban areas and other areas

1 124 were dominated by women who lived in rural areas. The majority of mothers were secondary  
2 125 school graduates and they did not work, except the Papua region whose majority of mothers  
3 126 actively worked. All regions were dominated by women with poor economic status, except the  
4 127 Java-Bali region which was dominated by women with rich economic status. All regions were  
5 128 dominated by mothers who had  $\geq 1$  parity, making  $\geq 4$  times antenatal care visits during their  
6 129 pregnancy, and gave birth in health facilities, except Maluku regions where the majority of  
7 130 deliveries were still carried out in non-health facilities. The type of delivery was mostly done by  
8 131 vaginal delivery. Early initiation of breastfeeding was mostly done within  $\leq 1$  hour, but it took  $\geq 1$   
9 132 hour of breastfeeding in Sumatera and Sulawesi. The majority of mothers made postnatal care  
10 133 visits.  
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**Table 1. Respondent Characteristics (n = 1,621).**

Variable	n	%	Regions													
			Sumatera (n = 403)		Java-Bali (n = 856)		Nusa Tenggara (n = 78)		Kalimantan (n = 91)		Sulawesi (n = 133)		Maluku (n =23)		Papua (n=37)	
			n	%	N	%	n	%	n	%	N	%	n	%	n	%
<b>The Practice of Exclusive Breastfeeding</b>																
Exclusive Breastfeeding	837	51.6	198	49.1	441	51.5	56	72.3	34	37.5	77	57.8	10	41.1	21	56.1
Non-exclusive Breastfeeding	784	48.4	205	50.9	415	48.5	22	27.7	57	62.5	56	42.2	13	58.9	16	43.9
<b>Maternal Age</b>																
35-49	315	19.4	80	19.8	159	18.6	17	21.2	19	21.3	32	24.1	2	10.6	6	15.4
20-34	1191	73.5	293	72.7	637	74.4	57	72.9	63	68.9	94	70.5	17	73.9	30	83.7
15-19	115	7.1	30	7.4	60	7.0	4	5.9	9	9.8	7	5.4	4	15.4	1	0.9
<b>Child's Age (Months)</b>																
0-1	404	24.9	114	28.2	200	23.4	21	26.5	22	24.1	34	25.7	5	20.0	9	23.2
2-3	618	38.1	154	38.2	331	38.7	28	36.8	35	38.1	47	35.3	8	37.7	15	40.3
4-5	599	37.0	135	33.6	325	38.0	29	37.7	34	37.8	52	38.9	10	42.2	13	36.5
<b>Residence</b>																
Rural	870	53.6	279	69.2	333	38.8	60	76.3	59	64.4	96	72.4	15	64.2	29	78.9
Urban	751	46.4	124	30.8	523	61.2	18	23.7	32	35.6	37	27.6	8	35.8	8	21.1
<b>Education</b>																
Higher	254	15.7	72	17.8	117	13.7	11	13.9	11	11.5	32	23.8	5	21.3	7	19.0
Secondary	968	59.7	228	56.5	552	64.5	39	49.5	47	51.9	67	50.2	15	64.9	21	55.8
Primary	399	24.6	103	25.6	187	21.8	28	36.6	33	36.6	34	25.9	3	13.8	9	25.2
<b>Occupation</b>																
Not Working	961	59.3	229	56.9	527	61.5	50	63.7	57	62.3	68	51.4	15	63.9	17	44.5
Working	659	40.7	174	43.1	329	38.5	28	36.3	34	37.7	65	48.6	8	36.1	20	55.5
<b>Economic Status</b>																
Upper	599	36.9	122	30.3	408	47.7	8	10.2	21	23.3	29	22.0	3	12.8	7	19.0
Middle	341	21.0	89	22.1	198	23.1	5	6.9	20	22.2	23	16.8	3	14.3	3	7.4
Lower	681	42.0	192	47.6	250	29.2	65	82.9	50	54.6	81	61.2	17	72.9	27	73.6
<b>Parity</b>																
>1	1120	69.1	289	71.8	567	66.3	59	75.9	64	70.5	96	72.0	14	61.6	30	81.9
1	501	30.9	114	28.2	289	33.7	19	24.1	27	29.5	37	28.0	9	38.4	7	18.1
<b>Number of Antenatal Care Visits</b>																
>=4	1426	87.9	323	80.2	790	92.3	71	90.3	83	91.0	115	86.7	17	73.6	27	72.5
<4	195	12.1	80	19.8	66	7.7	7	9.7	8	9.0	18	13.3	6	26.4	10	27.5
<b>Place of Delivery</b>																
Health Facilities	1373	84.7	323	80.0	792	92.5	63	80.7	64	70.7	102	76.4	9	40.1	20	55.4
Non-Health Facilities	248	15.3	80	20.0	64	7.5	15	19.3	27	29.3	31	23.6	14	59.9	17	44.6
<b>Type of Delivery</b>																
Vaginal	1326	81.8	325	80.6	689	80.5	69	88.6	78	85.5	110	82.6	21	93.0	34	91.8
Caesar	295	18.2	78	19.4	167	19.5	9	11.4	13	14.5	23	17.4	2	7.0	3	8.2
<b>Early Initiation of Breastfeeding</b>																
<1 Hour	858	52.9	175	43.3	486	56.7	56	71.9	47	51.6	62	46.5	12	53.6	20	54.9
>1 Hour	763	47.1	228	56.7	370	43.3	22	28.1	44	48.4	71	53.5	11	46.4	17	45.1
<b>Postnatal Care Visit within 2 Months</b>																
Yes	1028	63.4	236	58.6	580	67.8	46	59.4	52	56.7	81	60.8	12	52.1	21	55.9
No	593	36.6	167	41.4	276	32.2	32	40.6	39	43.3	52	39.2	11	47.9	16	44.1

1 **Table 2. Binary Logistics Regression Analysis by Region**

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3

Variables	Exclusive Breastfeeding		
	OR	95%CI	P Value
<b>Region</b>			
Sumatera	1.610	1.011-2.565	0.045
Java-Bali	1.773	1.114-2.822	0.016
Nusa Tenggara	4.348	2.423-7.800	0.000
Sulawesi	2.286	1.380-3.788	0.001
Maluku Islands	1.165	0.660-2.057	0.598
Papua	2.133	0.904-5.033	0.084
Kalimantan	<i>Ref.</i>		

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16 Table 2 shows the results of the binary logistic regression test for regional disparities of

17 exclusive breastfeeding in Indonesia. This analysis used Kalimantan region as a reference because

18 it had the lowest percentage of exclusive breastfeeding. Mothers in the Nusa Tenggara region had a

19 4,348 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR 4,348;

20 95% CI 2,423-7,800). Mothers in Sulawesi region had a 2,286 times higher chance of exclusive

21 breastfeeding than those in Kalimantan region (OR 2,286; 95% CI 1,380-3,788). Mothers in

22 Sumatra region had a 1,610 times higher chance of exclusive breastfeeding than those in

23 Kalimantan region (OR 1.610; 95% CI 1.011-2,565). Similarly, mothers in Java-Bali region who

24 had a 1.773 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR

25 1.773; 95% CI 1.114-2.822).

26

27 Table 3 presents that the variables of child's age, mother's education, occupation, economic

28 status, number of antenatal care visits, early initiation of breastfeeding, and postnatal care visits

29 had a relationship with exclusive breastfeeding. Children aged 0-1 month and 2-3 months in all

30 regions, except Kalimantan ( $p > 0.05$ ), had a higher chance of exclusive breastfeeding than those

31 aged 4-5 months. Mothers in Sumatra region who were secondary school graduates had a 1,772

32 times higher chance of exclusive breastfeeding than those with lower education (OR 1,772; 95%

33 CI 1,077-2,916). Mothers in Java-Bali region who did not work had a 2,500 times higher chance

34 of exclusive breastfeeding than those who worked (OR 2,500; 95% CI 1.591-3,928). Mothers

35 with middle to upper economic status had a lower chance of exclusive breastfeeding compared to

36 mothers with poorer economic status in Sumatra (OR 0.472; 95% CI 0.257-0.869) and the Java-

37 Bali region (OR 0.415; 95% CI 0.230-0.746).

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**Table 3. The Relationship between Independent Variables and The Practice of Exclusive Breastfeeding by Region in Indonesia**

Variables	Exclusive Breastfeeding																			
	Indonesia			Sumatera			Java-Bali			Nusa Tenggara			Kalimantan							
	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value				
		Lower	Upper		Lower	Upper		Lower	Upper	Lower	Upper		Lower	Upper						
<b>Maternal Age</b>																				
25-49	0.965	0.530	1.756	0.906	1.194	0.439	3.246	0.727	0.943	0.340	2.613	0.910	0.688	0.055	8.676	0.770	0.552	0.106	2.874	0.476
20-34	1.115	0.680	1.828	0.665	1.011	0.445	2.299	0.979	0.923	0.416	2.052	0.845	2.710	0.272	27.051	0.391	3.140	0.597	16.521	0.174
15-19	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Child's Age (Months)</b>																				
3-4	3.359	2.396	4.710	0.000	3.128	1.686	5.806	0.000	3.592	2.016	6.401	0.000	27.181	4.884	151.282	0.000	1.722	0.539	5.501	0.354
2-8	2.019	1.507	2.704	0.000	1.958	1.110	3.455	0.021	1.885	1.182	3.005	0.008	3.916	1.611	9.520	0.003	1.255	0.367	4.292	0.714
4-5	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Residence</b>																				
Rural	1.238	0.929	1.651	0.145	1.315	0.811	2.134	0.266	1.218	0.760	1.952	0.411	1.703	0.364	7.963	0.494	1.639	0.638	4.209	0.300
Urban	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Education</b>																				
Higher	1.460	0.919	2.319	0.109	1.371	0.590	3.187	0.462	1.575	0.695	3.571	0.276	2.150	0.491	9.410	0.305	3.543	0.531	23.621	0.188
Secondary	1.210	0.864	1.694	0.266	1.772	1.077	2.916	0.025	1.116	0.609	2.045	0.722	0.622	0.211	1.833	0.385	0.858	0.240	3.062	0.811
Primary	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Occupation</b>																				
Not Working	1.578	1.198	2.078	0.001	0.864	0.514	1.453	0.580	2.500	1.591	3.928	0.000	1.536	0.571	4.130	0.390	2.308	0.670	7.955	0.182
Working	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Economic Status</b>																				
Upper	0.662	0.457	0.958	0.029	0.802	0.443	1.453	0.466	0.571	0.301	1.083	0.086	0.763	0.153	3.808	0.739	1.783	0.347	9.171	0.484
Middle	0.481	0.341	0.678	0.000	0.472	0.257	0.869	0.016	0.415	0.230	0.746	0.003	1.190	0.125	11.355	0.878	0.659	0.190	2.287	0.507
Lower	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Parity</b>																				
>1	1.286	0.937	1.766	0.120	1.260	0.677	2.343	0.464	1.136	0.692	1.866	0.613	1.443	0.397	5.254	0.574	1.021	0.347	3.005	0.970
1	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Number of Antenatal Care Visits</b>																				
4-8	1.409	0.962	2.064	0.078	1.491	0.807	2.754	0.202	1.501	0.699	3.223	0.297	19.400	4.549	82.743	0.000	0.704	0.173	2.859	0.620
4-9	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Place of Delivery</b>																				
Health Facilities	0.898	0.629	1.283	0.556	0.641	0.342	1.201	0.164	.972	.420	2.246	0.947	0.622	0.239	1.623	0.328	0.519	0.156	1.732	0.282
Non-Health Facilities	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Type of Delivery</b>																				
Vaginal	1.217	0.837	1.769	0.303	1.193	0.638	2.230	0.579	1.397	0.772	2.526	0.268	0.786	0.158	3.909	0.766	0.342	0.084	1.395	0.133
Cesarean	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Early Initiation of Breastfeeding</b>																				
<1 Hour	1.693	1.308	2.191	0.000	1.602	0.997	2.572	0.051	1.608	1.044	2.478	0.031	1.390	0.516	3.744	0.511	4.792	1.738	13.213	0.003
>1 Hour	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Postnatal Care Visits within 2 Months</b>																				
No	0.974	0.746	1.273	0.849	1.493	0.945	2.360	0.086	0.797	0.499	1.274	0.342	0.753	0.270	2.103	0.584	1.366	0.515	3.623	0.526
Yes	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.

**Table 3. The Relationship between Independent Variables and The Practice of Exclusive Breastfeeding by Region in Indonesia (continuation)**

Variables	Exclusive Breastfeeding											
	Sulawesi				Maluku			Papua				
	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value
	Lower	Upper			Lower	Upper			Lower	Upper		
<b>Maternal Age</b>												
35-49	0.344	0.054	2.199	0.258	0.398	0.029	5.506	0.486	1.417	0.123	1.631	0.895
20-34	0.768	0.132	4.463	0.768	1.287	0.276	6.012	0.745	0.848	0.110	6.541	0.914
15-19	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Child's Age (Months)</b>												
0-1	2.035	0.876	4.726	0.098	<b>3.489</b>	<b>1.003</b>	<b>12.136</b>	<b>0.049</b>	4.948	0.564	43.391	0.142
2-3	<b>2.850</b>	<b>1.417</b>	<b>5.730</b>	<b>0.004</b>	<b>3.912</b>	<b>1.328</b>	<b>11.520</b>	<b>0.014</b>	<b>7.715</b>	<b>1.401</b>	<b>42.470</b>	<b>0.021</b>
4-5	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Residence</b>												
Rural	1.664	0.847	3.269	0.138	1.054	0.329	3.378	0.928	0.083	0.001	6.516	0.252
Urban	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Education</b>												
Higher	0.937	0.336	2.614	0.901	1.641	0.402	6.696	0.485	0.350	0.013	9.231	0.516
Secondary	1.522	0.691	3.352	0.295	1.506	0.429	5.279	0.517	1.012	0.175	5.850	0.989
Primary	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Occupation</b>												
Not Working	0.751	0.377	1.496	0.413	1.444	0.606	3.443	0.402	0.428	0.109	1.688	0.215
Working	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Economic Status</b>												
Upper	0.808	0.327	1.996	0.642	0.711	0.181	2.790	0.620	0.091	0.000	24.012	0.385
Middle	0.572	0.234	1.400	0.220	0.584	0.150	2.279	0.433	0.108	0.002	6.133	0.268
Lower	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Parity</b>												
>1	1.622	0.703	3.745	0.255	1.845	0.681	4.999	0.225	1.308	0.078	21.815	0.846
1	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Number of Antenatal Care Visits</b>												
>=4	0.991	0.417	2.355	0.984	1.807	0.589	5.547	0.296	0.966	0.121	7.710	0.973
<4	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Place of Delivery</b>												
Health Facilities	0.759	0.370	1.558	0.450	0.708	0.240	2.092	0.527	2.366	0.162	34.460	0.515
Non-health Facilities	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Type of Delivery</b>												
Vaginal	0.660	0.254	1.711	0.390	3.607	0.236	55.059	0.351	2.614	0.273	25.030	0.525
Caesar	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Early Initiation of Breastfeeding</b>												
<1 Hour	1.727	0.893	3.340	0.104	1.024	0.401	2.615	0.959	0.900	0.160	5.083	0.902
>1 Hour	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.
<b>Postnatal Care Visits within 2 Months</b>												
Yes	<b>0.432</b>	<b>0.224</b>	<b>0.830</b>	<b>0.012</b>	<b>0.407</b>	<b>0.179</b>	<b>0.924</b>	<b>0.032</b>	0.595	0.112	3.150	0.528
No	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.	<i>Ref.</i>	.	.	.

## DISCUSSION

This study shows that there are substantial variations in exclusive breastfeeding in all regions in Indonesia. This study reported that certain regions have diverse socio-economic, religious, cultural, and geographical conditions. Mothers living in Nusa Tenggara region had the highest prevalence of exclusive breastfeeding, while those in Kalimantan region was the lowest. The results of the binary logistic regression analysis revealed that all regions, except Maluku Islands and Papua, had significant differences in exclusive breastfeeding compared to Kalimantan region servings as a reference. However, the differences were not significant in Maluku Islands, Papua, and the Kalimantan regions. In other words, mothers who lived in Nusa Tenggara, Java-Bali, Sulawesi, and Sumatra regions had a higher chance of exclusive breastfeeding compared to those in Kalimantan regions.

West Nusa Tenggara was the province with the highest coverage of exclusive breastfeeding in Indonesia, even in the last 5 years [9]. West Nusa Tenggara province has implemented Early Breastfeeding Initiation (IMD) and exclusive breastfeeding programs since 2010. It also has initiated Regional Regulation No. 7 of 2011 concerning the Protection and Improvement of Maternal and Child Health which requires IMD and exclusive breastfeeding. This exclusive breastfeeding was even conducted before the enactment of Government Regulation of the Republic of Indonesia No. 33 of 2012 concerning Exclusive Breastfeeding. After the regional regulations were enacted, the regional government had to disseminate the information to the community and related parties, such as hospitals and health centers. It is recommended that health services should develop written policies to support exclusive breastfeeding, provide early initiation of breastfeeding services, and provide training for health workers to encourage and assist mothers to give exclusive breastfeeding either directly or indirectly, in maternity clinics or general hospitals [21].

This study also shows that mothers living in Kalimantan were less likely to exclusively breastfeed their babies than those living in Java-Bali known as urban islands. In general, people who lived in urban areas had a better education than those living in rural areas. For this reason, mothers living in urban areas tend to have a better access to health facilities and information, such as lactation consultation and support. [22,23].

Kalimantan regions had a lower rate of exclusive breastfeeding compared to other regions. Several studies conducted in Kalimantan showed that a strong predictor of non-exclusive breastfeeding was low education. Mothers were less aware of the benefits of exclusive breastfeeding, most of whom believed that additional food could make their babies grow faster. The regional government contributed to this unfortunate situation since guidelines, information, socialization on the exclusive breastfeeding were not promoted to local mothers. Even, sanctions for public operators who failed to support the exclusive breastfeeding facilities were not upheld. As a result, the implementation of exclusive breastfeeding in the Kalimantan regions was less optimum [24,25].

Various government policies related to exclusive breastfeeding have been established, including Law Number 36 of 2009, Article 128 paragraphs 2 and 3. The policies state that during breastfeeding, families, regional governments, and the community must fully support mothers by providing time and required facilities. Although some regions have followed up with these regional regulations, a few have ignored them. [26].

To date, the traditional practice of infant feeding among indigenous tribes is still quite high. In eastern Indonesia, babies who are only a few days old are often fed with liquid called sago solution as a nutritional intake. They are given mashed food when they are 2-3 months old [27–29]. Another study stated that the Javanese tradition gives sugar solution to babies since they are a few days old [30], and Gayo people have a tradition of applying honey to the lips of newborn babies

1 [31]. This traditional practice, on the other hand, is a challenge for health workers who have to  
2 promote exclusive breastfeeding [32]. Women living in different areas with different cultural  
3 backgrounds and beliefs may have different nutritional behaviors, including the practice of  
4 exclusive breastfeeding [33]. Therefore, efforts to promote exclusive breastfeeding must consider  
5 the socio-cultural and environmental conditions of the target population.  
6

7 This study shows that there was a significant relationship ( $p < 0.05$ ) between maternal  
8 education and exclusive breastfeeding in Sumatra region. Mothers who graduated from secondary  
9 school had a higher chance of exclusive breastfeeding than those with lower education. In line with  
10 previous studies, holding higher education degree tends to make mothers more likely to exclusively  
11 breastfeed their babies [34]. Higher education opens more access to information and thus allows  
12 mothers to think more rationally about the benefits of exclusive breastfeeding. Although it has a  
13 positive effect, higher education also opens wider access for mothers to work. In this study, the  
14 absence of a significant relationship between education and exclusive breastfeeding in other  
15 regions could cause constraints such as short maternity leave that requires mothers to return to  
16 work before the exclusive breastfeeding period ends [35].  
17

18 In Java-Bali, mothers who did not work had a higher chance of exclusive breastfeeding  
19 than those who worked. This is in line with several previous studies which found a positive  
20 relationship between non-working mothers and exclusive breastfeeding [13,35–37]. Mothers who  
21 do not work tend to have more time with their babies. On the other hand, working mothers tend to  
22 have less time with their babies due to work, resulting in shorter breastfeeding durations which in  
23 turn inhibits exclusive breastfeeding [35]. In this case, working mothers face several challenges  
24 such as conflicting commitments at work, limited support from the workplace, and a lack of  
25 breastfeeding facilities [38]. It may be caused the women's ability to balance their family and  
26 work- women breastfeed for as long as possible while also working to provide an income for  
27 themselves and their children.  
28

29 This study shows that it is important to provide breastfeeding support to working mothers.  
30 The workplace should provide a private and safe place (such as a lactation room) for pumping,  
31 equipment needed for milk preservation, and breastfeeding breaks. In addition, previous studies  
32 have shown that longer maternity leave contributes to a longer duration of exclusive breastfeeding  
33 among working mothers [38,39].  
34

35 Mothers from low socioeconomic groups in Sumatra and Java-Bali were more likely to  
36 give exclusive breastfeeding than those from upper middle economic groups. This finding is in line  
37 with several previous studies [40–42]. This finding, however, surprisingly showed low-income  
38 families have more limited resources to buy alternative foods for their babies and it causes  
39 breastfeeding the only option. In addition, high-income households have a better access to  
40 education and hence a greater opportunity for professional work. Meanwhile, working mothers tend  
41 to be less likely to give exclusive breastfeeding, especially if they do not receive support from the  
42 workplace [41,42]. However, this study is not in line with several previous studies conducted in  
43 Somali and Ethiopia which stated that high-income households tend to have a positive relationship  
44 with exclusive breastfeeding because they have a greater chance of being exposed to various media  
45 and better knowledge of exclusive breastfeeding [43,44].  
46

47 In this study, mothers in Nusa Tenggara who had  $\geq 4$  times antenatal care visits during  
48 their pregnancy had a higher chance of exclusive breastfeeding than those who had  $\leq 4$  times  
49 antenatal care visits [45]. A study conducted in Sweden found that, during antenatal care visits,  
50 most mothers asked for knowledge about the physiology of breastfeeding, signs of adequate milk  
51 supply, and ways to increase milk supply [46]. A qualitative study in Bhutan showed that one of  
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1 the reasons why mothers use formula milk is the belief that they are not producing sufficient breast  
2 milk [47]. Therefore, counseling sessions during antenatal care visits are important to increase self-  
3 confidence and positive views about breastfeeding. Previous studies have shown that mothers who  
4 live in Nusa Tenggara have a 4,365 times higher chance ( $\geq 4$ ) to make antenatal care visits than  
5 those in other regions [18].  
6

7 In Java-Bali and Kalimantan, mothers who initiated early breastfeeding within  $\leq 1$  hour  
8 after delivery had a higher chance of exclusive breastfeeding than those who initiate within  $\geq 1$   
9 hour after delivery. This finding is in line with several previous studies [11,48]. The World Health  
10 Organization (WHO) explains that early initiation of breastfeeding can increase the chances of  
11 exclusive breastfeeding in 1-4 months after delivery [49]. Furthermore, this study shows that, in  
12 Sulawesi and Maluku, respondents who visited postnatal care within two months after delivery had  
13 a lower chance of exclusive breastfeeding. This may be due to the absence of breastfeeding  
14 counseling during postnatal care visits. In this study, the majority of mothers living in Maluku  
15 (64%) did not receive counseling about exclusive breastfeeding within the first two days after  
16 delivery. In line with the Indonesia Demographic and Health Survey 2017, this study also shows  
17 that, from several types of newborn care, only 48-59% of mothers received information about  
18 warning signs and breastfeeding counseling [8]. It may be the factors that increase the risk of low  
19 supply.  
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24 The strength of this study lies in the use of secondary data from the Indonesia  
25 Demographic and Health Survey 2017 which covers all data across regions in Indonesia. The use of  
26 a large sample and a nationally representative sampling procedure method made it possible to  
27 generalize the results of this study to all mothers throughout Indonesia. In addition, data weighting  
28 was also carried out during the analysis process to adjust disproportionate sampling techniques.  
29 This survey had a high response rate of 97.8% [8]. Data were collected by skilled personnel using  
30 standardized questionnaires to ensure the success of the survey and to obtain qualified data. Apart  
31 from the strengths, this study also had some limitations, some of which was the use of a small  
32 number of variables related to exclusive breastfeeding. Other variables include sex of the infant,  
33 birth weight, birth spacing, cultural perceptions, beliefs, and family support. Another limitation was  
34 the use of a cross-sectional analytical design that merely studied the relationships between  
35 variables without considering the cause-and-effect relationships between variables. Finally,  
36 exclusive breastfeeding was measured based on a history of information about food and drink given  
37 to infants aged 0-5 months in the last 24 hours before the survey was conducted without  
38 considering the previous period. As a result, this may lead to a misclassification bias of exclusive  
39 breastfeeding.  
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## 46 CONCLUSION

47 This study shows substantial variations in proportions and determinants of exclusive  
48 breastfeeding across all regions in Indonesia. -Nusa Tenggara region had the highest proportion of  
49 exclusive breastfeeding, while Kalimantan region had the lowest one. The factors associated with  
50 exclusive breastfeeding varied widely in all regions, where the child's age was the only common  
51 factor associated with exclusive breastfeeding, except Kalimantan region. Other variables related to  
52 exclusive breastfeeding were secondary education in -Sumatra region, occupation in Java-Bali  
53 region, economic status in Sumatra and Java-Bali regions, early initiation of breastfeeding in Java-  
54 Bali and Kalimantan regions, postnatal care visits in Sulawesi and Maluku Island regions, and  
55 antenatal care visits in Nusa Tenggara region. Appropriate policies and strategies are needed to  
56 increase exclusive breastfeeding in all regions to reduce disparity in exclusive breastfeeding.  
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1 Optimizing existing policies, the central government can impose strict sanctions on local  
2 governments and public facility operators who do not implement exclusive breastfeeding  
3 regulations. Future researchers are expected to examine variables that have not been covered in this  
4 study. These variables include sex of the infant, birth weight, birth spacing, cultural perceptions,  
5 beliefs, and family support for exclusive breastfeeding.  
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7

### 8 **Ethical approval**

9 We used secondary data. Ethical clearance was obtained in the 2017 IDHS from the National ethics  
10 committee. Respondents provided written approval for their involvement in the study. We have  
11 obtained permission to use the data through the following website: [https://dhsprogram.com/  
12 data/new-user-registration.cfm](https://dhsprogram.com/data/new-user-registration.cfm).  
13  
14

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16 The authors should state that they have no funding for the research  
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### 19 **Competing Interest**

20 The author declares that no conflicts of interest  
21  
22

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**Your Submission PUHE-D-22-02047**

1 pesan

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Manuscript Title: THE PRACTICE OF EXCLUSIVE BREASTFEEDING BY REGION IN INDONESIA

Public Health

Dear Miss haerawati idris

Thank you for submitting the above paper to Public Health. We have now received the referees' reports, which you will find below.

If you were able to suitably revise your paper, in line with the comments, we would wish to reconsider it for publication in Public Health.

To submit a revision, go to <http://ees.elsevier.com/puhe/> and log in as an Author. You will see a menu item call Submission Needing Revision. You will find your submission record there.

Please ensure you highlight or track all changes made to your manuscript and provide a point-by-point response to the reviewer's comments.

Please can you submit your revised paper by Feb 02 2023 11:59PM. Please note that any papers that are received after this 3 week deadline will not be considered by the Editors, unless you agree an extension with the editorial office.

I look forward to hearing from you.

Yours sincerely

Editorial Office, Public Health

Editor's comments: Could you please revise based on the reviewer's feedback below, and also could you please ask a native English speaker to check the article for language issues.

Reviewer #1: Thank you for an interesting and comprehensive study on the factors associated with breastfeeding practices in Indonesia.

**Introduction**

Lines 17-21: It says here that the % of exclusively breastfed children increased by 11% between 2012 and 2017, from 42% to 52%. This is a 10% increase, not 11%. Please also clarify that means the initiation of exclusive breastfeeding at birth. It also says that the % of children not exclusively breastfed increased from 11% to 12% in the same period - are you referring to partial/combination feeding here?

Line 23: To acknowledge the achievement of 50% exclusive breastfeeding initiation at birth, you could expand a little more. Were there any notable social developments during this time that contributed to the success of the strategy?

Line 52: Is there a word missing after "development"?

**Methods**

Lines 15-20: Can you clarify the % of mothers excluded from the study by category, e.g. 30% excluded due to incomplete data, 5% due to twins, etc.

**Results**

Line 5: Change "normal" delivery to vaginal delivery.

Table 1: Change "normal" delivery to vaginal delivery.

Table 3: Change "normal" delivery to vaginal delivery.

**Discussion**

Line 4: Change the word "proves". It's a cross-sectional study - causation cannot be determined.

Lines 29-30: The statement that working mothers struggle to balance work and family life is not referenced. It could also be argued that the balance currently achieved - where women breastfeed for as long as possible while also

working to provide an income for themselves and their other children - is the best balance that can be currently achieved.

Line 20: You mention "danger signs". Are these the factors that increase the risk of low supply?

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## THE PRACTICE OF EXCLUSIVE BREASTFEEDING BY REGION IN INDONESIA

### ABSTRACT

*Objective:* Exclusive breastfeeding has important benefits for both children and mothers. However, the proportion of exclusive breastfeeding is still not evenly distributed among regions, including in Indonesia. The purpose of this study was to analyze the practice of exclusive breastfeeding by region in Indonesia and its influencing factors.

*Study Design:* This study was cross sectional study.

*Methods:* This study used secondary data from the Indonesia Demographic and Health Survey 2017. The total sample was 1,621 respondents which consisted of mothers whose last child was under six months old and was still alive; the mothers did not have twins and lived with their child. Data were analyzed by using Quantum GIS and binary logistic regression statistical tests.

*Results:* This study shows that 51.6% of respondents gave exclusive breastfeeding in Indonesia. The highest proportion was in Nusa Tenggara region (72.3%), while the lowest was in Kalimantan province (37.5%). Mothers who lived in the regions of Nusa Tenggara, Sulawesi, Java-Bali, and Sumatra had a higher chance of exclusive breastfeeding compared to those of in Kalimantan region. The factors associated with the exclusive breastfeeding vary widely across all regions, and the child's age is the only common factor associated with the exclusive breastfeeding in all regions, except Kalimantan.

*Conclusion:* This study shows wide variation in regional proportions and determinants of exclusive breastfeeding in Indonesia. Therefore, appropriate policies and strategies are needed to increase equitable exclusive breastfeeding practices across all regions in Indonesia.

**Keywords:** Exclusive breastfeeding, regions, Indonesia, logistics, binary



## 1 INTRODUCTION

2 Breast milk (ASI) contains nutrients that are essential for the health, growth, and  
3 development of a baby [1]. Breastfeeding is one of the public health interventions to reduce the  
4 baby mortality, [2] the baby's risk of contracting digestive diseases, respiratory infections, and  
5 obesity. On the other hand, the exclusive breastfeeding can improve children's cognitive abilities  
6 [3–5] and contribute to prevent mothers from the risk of developing breast and ovarian cancer and  
7 to reduce the risk of obesity and chronic diseases such as type II diabetes mellitus [6]. In Indonesia,  
8 the infant mortality rate was 21 per 1,000 live births in 2018, higher than other developing South-  
9 East Asian countries, such as Vietnam (16 per 1,000 live births), Thailand (8 per 1,000 live births),  
10 and Malaysia (7 per 1,000 live births) [7]. Exclusive breastfeeding is the process of feeding infants  
11 during the first 1 hour after giving birth. According to the Indonesia Demographic and Health  
12 Survey 2017, the coverage of exclusive breastfeeding for children under six months old increased  
13 by 10% in the last 5 years, from 42% in 2012 to 52% in 2017. It shows that 48% of children under  
14 six months old across Indonesia were not exclusively breastfed. The percentage of children who  
15 did not get breast milk at all increased from 8% in the Indonesia Demographic and Health Survey  
16 2012 to 12% in the Indonesia Demographic and Health Survey 2017 [8].

17 The achievement of exclusive breastfeeding in Indonesia has met the minimum target of  
18 50% set in the national development plan for the last five years. Some regulations implemented  
19 support exclusive breastfeeding in Indonesia. However, the proportion of exclusive breastfeeding  
20 decreases as the children get older. The proportion of children receiving exclusive breastfeeding  
21 varies. Around 67% were children aged under one month, 55% were aged 2-3 months, and 38%  
22 were aged 4-5 months [8]. The proportion of exclusive breastfeeding in Indonesia is still not evenly  
23 distributed among provinces and even gaps exist among them. The five provinces with the highest  
24 rates of exclusive breastfeeding were West Nusa Tenggara, East Kalimantan, East Java, the Special  
25 Region of Yogyakarta, and East Nusa Tenggara, whilst other five lowest-achievement provinces  
26 were North Sumatra, Gorontalo, Maluku, Papua, and West Papua [9].

27 Several previous studies in Indonesia have revealed the scope and determinants of  
28 exclusive breastfeeding. A national study based on an analysis of the Indonesia Demographic  
29 and Health Survey from 2002 to 2017 showed that the proportion of mothers who exclusively  
30 breastfed their babies increased significantly between 2002 and 2017, with a greater increase  
31 among mothers from the higher wealth quintiles, working in professional sectors, and living in  
32 Java and Bali [10]. In general, the factors linked to the exclusive breastfeeding include the child's  
33 age, mother's education, occupation, type of delivery, parity, economic status, residence, and  
34 early initiation of breastfeeding [11–14]. In addition to the wide geographical,  
35 sociodemographic, and cultural diversity in Indonesia, it is important to study exclusive  
36 breastfeeding by region. To illustrate, eastern Indonesian socio-economic developments such as  
37 industry, housing, public transportation, road facilities, and health facilities are slower than those  
38 in western Indonesia, especially in Java region [15–18]. Therefore, this study aims to analyze the  
39 practice of exclusive breastfeeding by region in Indonesia using nationally representative data  
40 from the Indonesia Demographic and Health Survey 2017. This study can complete the big  
41 picture of the exclusive breastfeeding phenomena in Indonesia which can resolve the Indonesian  
42 exclusive breastfeeding. The purpose of this study is to analyze the practice of exclusive  
43 breastfeeding by region in Indonesia and factors that influence it.

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## 48 **METHODS**

49

### 50 **Data Source**

51 This study performed secondary data analysis. Data were taken from the Indonesia  
52 Demographic and Health Survey (IDHS) 2017. IDHS is part of the International Demographic and  
53 Health Survey (DHS) program organized by the Inner-City Fund (ICF) to provide a comprehensive  
54 picture of the population as well as maternal and child health in Indonesia. The sample from IDHS  
55 2017 was designed to present national and provincial estimates. It covered 1,970 census blocks  
56 covering both urban and rural areas.

57 This survey used a two-stage stratified cluster sampling method. The first stage was the  
58 selection of several census blocks using a systematic probability proportional to measure (PPS) the  
59 number of households obtained from the SP2010 listing. The second stage selected 25 ordinary  
60 households using systematic sampling from the list. The population of this study was 49,692  
61 Indonesian women of childbearing age (15-49 years) - data was from the 2017 IDHS. The sample  
62 used in this study was part of the population with some inclusion criteria, namely mothers whose  
63 last child was under six months old and still alive, they did not have twins and lived with their  
64 child. 10% was excluded due to incomplete data, 1% was due to twins and 1% was the missing  
65 data. Finally, the samples of this study were 1,621 altogether. The mothers with incomplete data  
66 were not included in the analysis [8].

67

### 68 **Result Variables**

69 The proportion of exclusive breastfeeding refers to infants under six months old who receive  
70 not only breast milk as their source of food, but also oral rehydration solutions, vitamin drops or  
71 syrup, and medications). The data were collected from the mother's memory of the food given to  
72 her baby in the last 24 hours prior to the survey and it is in line with the WHO/UNICEF guidelines  
73 to assess the feeding practices to infants and children [19]. Result variables were defined in binary  
74 categories, exclusive breastfeeding and unexclusive breastfeeding.

75

### 76 **Research Factor**

77 Research factors were adapted from previous studies [11,13,14]. These included predisposing  
78 factors and enabling factors. Predisposing factors include maternal age, child age, education,  
79 employment status, economic status, residence, parity, and early initiation of breastfeeding.  
80 Enabling factors include the number of antenatal care visits, place of delivery, type of delivery, and  
81 a number of postnatal care visits.

82 Maternal age was divided into three age groups, namely 15-19 years, 20-34 years, and 35-49  
83 years. Children's age was divided into three age groups, all of which are 0-1 month, 2-3 months and  
84 4-5 months, and mother's education was divided into three groups; low (no school or elementary  
85 school graduates), middle (secondary school graduates), and higher (college graduates). Mother's  
86 occupation was divided into employed (e.g., professional, technician, manager and administration,  
87 clerk, sales, service, agricultural or industrial worker) and non-employed. Residence was divided  
88 into rural and urban. Using the wealth index, economic status in this study was classified into three  
89 groups, namely poor (poor and poorest), middle, and rich (rich and richest). Parity referred to the  
90 number of children born to the mothers and was categorized into 1 and >1. The number of antenatal  
91 care visits made by the mothers during pregnancy was categorized into  $\geq 4$  and  $< 4$ . Place of  
92 delivery was categorized into health facilities and non-health facilities. The type of delivery was  
93 categorized into vaginal delivery and cesarean section. Early initiation of breastfeeding was divided

94 into two categories, namely  $\leq 1$  hour and  $> 1$  hour. Postnatal care visits referred to children who  
95 were examined at a health facility in the first two months after birth.

96

### 97 Data Analysis

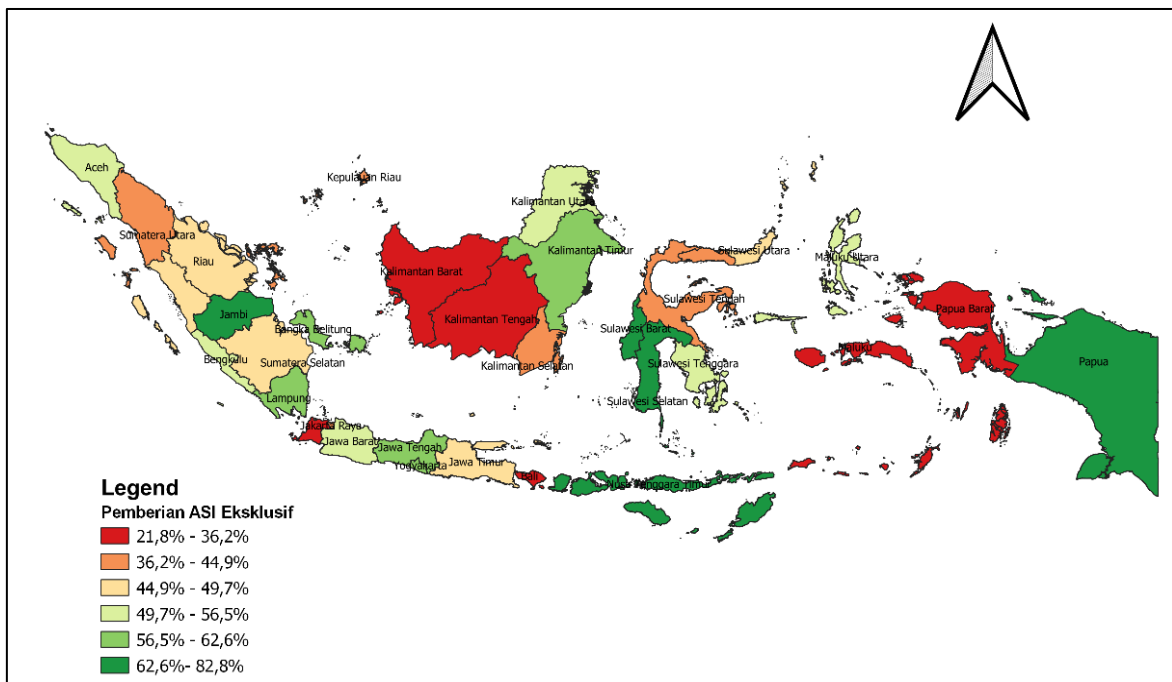
98 Data analysis was done by regions grouped based on the largest islands, namely Sumatra,  
99 Java-Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku Islands, and Papua [18,20]. Sample  
100 weights were used to analyze the data from the IDHS. All data were analyzed with a complex  
101 sample design. Statistical analyses i.e., univariate analysis and bivariate analysis were performed  
102 through binary logistic regression. The relationship between the independent and dependent  
103 variables was classified based on the p-value of the binary logistic regression test results, with  $p <$   
104  $0.05$  for statistically significant relationships. The direction of the relationship between the  
105 independent and dependent variables was seen based on the odd ratio value of the binary logistic  
106 regression test results, with a reference value of 1. Meanwhile, a spatial analysis was to find out the  
107 distribution map of exclusive breastfeeding by province in Indonesia. The analysis used the  
108 Statistical Product and Service Solutions (SPSS) software and Quantum GIS.

109

### 110 RESULTS

111 Figure 1 shows the distribution of exclusive breastfeeding in 34 provinces of Indonesia.  
112 Kalimantan region (West Kalimantan and Central Kalimantan), Maluku Island region (Maluku),  
113 and Papua region (West Papua) had the lowest distribution of exclusive breastfeeding. Meanwhile,  
114 the highest distribution of exclusive breastfeeding was in Nusa Tenggara region.  
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**Figure 1. Distribution of Exclusive Breastfeeding by Province in Indonesia**

### 118 Respondents Characteristics

119 Table 1 shows that the proportion of mothers who give exclusive breastfeeding in Indonesia is  
120 51.6%. The highest proportion of exclusive breastfeeding was in the Nusa Tenggara region (72.3%)  
121 and the lowest was in the Kalimantan region (37.5%). The majority of mothers were in the age  
122 group of 20-34 years. The majority of children were in the age group of 2-3 months and 4-5  
123 months. The Java-Bali region was dominated by women who lived in urban areas and other areas

124 were dominated by women who lived in rural areas. The majority of mothers were secondary  
125 school graduates and they did not work, except the Papua region whose majority of mothers  
126 actively worked. All regions were dominated by women with poor economic status, except the  
127 Java-Bali region which was dominated by women with rich economic status. All regions were  
128 dominated by mothers who had  $\geq 1$  parity, making  $\geq 4$  times antenatal care visits during their  
129 pregnancy, and gave birth in health facilities, except Maluku regions where the majority of  
130 deliveries were still carried out in non-health facilities. The type of delivery was mostly done by  
131 vaginal delivery. Early initiation of breastfeeding was mostly done within  $\leq 1$  hour, but it took  $\geq 1$   
132 hour of breastfeeding in Sumatera and Sulawesi. The majority of mothers made postnatal care  
133 visits.  
134

**Table 1. Respondent Characteristics (n = 1,621).**

Variable	n	%	Regions													
			Sumatera (n = 403)		Java-Bali (n = 856)		Nusa Tenggara (n = 78)		Kalimantan (n = 91)		Sulawesi (n = 133)		Maluku (n =23)		Papua (n=37)	
			n	%	N	%	n	%	n	%	N	%	n	%	n	%
<b>The Practice of Exclusive Breastfeeding</b>																
Exclusive Breastfeeding	837	51.6	198	49.1	441	51.5	56	72.3	34	37.5	77	57.8	10	41.1	21	56.1
Non-exclusive Breastfeeding	784	48.4	205	50.9	415	48.5	22	27.7	57	62.5	56	42.2	13	58.9	16	43.9
<b>Maternal Age</b>																
35-49	315	19.4	80	19.8	159	18.6	17	21.2	19	21.3	32	24.1	2	10.6	6	15.4
20-34	1191	73.5	293	72.7	637	74.4	57	72.9	63	68.9	94	70.5	17	73.9	30	83.7
15-19	115	7.1	30	7.4	60	7.0	4	5.9	9	9.8	7	5.4	4	15.4	1	0.9
<b>Child's Age (Months)</b>																
0-1	404	24.9	114	28.2	200	23.4	21	26.5	22	24.1	34	25.7	5	20.0	9	23.2
2-3	618	38.1	154	38.2	331	38.7	28	36.8	35	38.1	47	35.3	8	37.7	15	40.3
4-5	599	37.0	135	33.6	325	38.0	29	37.7	34	37.8	52	38.9	10	42.2	13	36.5
<b>Residence</b>																
Rural	870	53.6	279	69.2	333	38.8	60	76.3	59	64.4	96	72.4	15	64.2	29	78.9
Urban	751	46.4	124	30.8	523	61.2	18	23.7	32	35.6	37	27.6	8	35.8	8	21.1
<b>Education</b>																
Higher	254	15.7	72	17.8	117	13.7	11	13.9	11	11.5	32	23.8	5	21.3	7	19.0
Secondary	968	59.7	228	56.5	552	64.5	39	49.5	47	51.9	67	50.2	15	64.9	21	55.8
Primary	399	24.6	103	25.6	187	21.8	28	36.6	33	36.6	34	25.9	3	13.8	9	25.2
<b>Occupation</b>																
Not Working	961	59.3	229	56.9	527	61.5	50	63.7	57	62.3	68	51.4	15	63.9	17	44.5
Working	659	40.7	174	43.1	329	38.5	28	36.3	34	37.7	65	48.6	8	36.1	20	55.5
<b>Economic Status</b>																
Upper	599	36.9	122	30.3	408	47.7	8	10.2	21	23.3	29	22.0	3	12.8	7	19.0
Middle	341	21.0	89	22.1	198	23.1	5	6.9	20	22.2	23	16.8	3	14.3	3	7.4
Lower	681	42.0	192	47.6	250	29.2	65	82.9	50	54.6	81	61.2	17	72.9	27	73.6
<b>Parity</b>																
>1	1120	69.1	289	71.8	567	66.3	59	75.9	64	70.5	96	72.0	14	61.6	30	81.9
1	501	30.9	114	28.2	289	33.7	19	24.1	27	29.5	37	28.0	9	38.4	7	18.1
<b>Number of Antenatal Care Visits</b>																
>=4	1426	87.9	323	80.2	790	92.3	71	90.3	83	91.0	115	86.7	17	73.6	27	72.5
<4	195	12.1	80	19.8	66	7.7	7	9.7	8	9.0	18	13.3	6	26.4	10	27.5
<b>Place of Delivery</b>																
Health Facilities	1373	84.7	323	80.0	792	92.5	63	80.7	64	70.7	102	76.4	9	40.1	20	55.4
Non-Health Facilities	248	15.3	80	20.0	64	7.5	15	19.3	27	29.3	31	23.6	14	59.9	17	44.6
<b>Type of Delivery</b>																
Vaginal	1326	81.8	325	80.6	689	80.5	69	88.6	78	85.5	110	82.6	21	93.0	34	91.8
Caesar	295	18.2	78	19.4	167	19.5	9	11.4	13	14.5	23	17.4	2	7.0	3	8.2
<b>Early Initiation of Breastfeeding</b>																
<1 Hour	858	52.9	175	43.3	486	56.7	56	71.9	47	51.6	62	46.5	12	53.6	20	54.9
>1 Hour	763	47.1	228	56.7	370	43.3	22	28.1	44	48.4	71	53.5	11	46.4	17	45.1
<b>Postnatal Care Visit within 2 Months</b>																
Yes	1028	63.4	236	58.6	580	67.8	46	59.4	52	56.7	81	60.8	12	52.1	21	55.9
No	593	36.6	167	41.4	276	32.2	32	40.6	39	43.3	52	39.2	11	47.9	16	44.1

**Table 2. Binary Logistics Regression Analysis by Region**

Variables	Exclusive Breastfeeding		
	OR	95%CI	P Value
<b>Region</b>			
Sumatera	1.610	1.011-2.565	0.045
Java-Bali	1.773	1.114-2.822	0.016
Nusa Tenggara	4.348	2.423-7.800	0.000
Sulawesi	2.286	1.380-3.788	0.001
Maluku Islands	1.165	0.660-2.057	0.598
Papua	2.133	0.904-5.033	0.084
Kalimantan	<i>Ref.</i>		

Table 2 shows the results of the binary logistic regression test for regional disparities of exclusive breastfeeding in Indonesia. This analysis used Kalimantan region as a reference because it had the lowest percentage of exclusive breastfeeding. Mothers in the Nusa Tenggara region had a 4,348 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR 4,348; 95% CI 2,423-7,800). Mothers in Sulawesi region had a 2,286 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR 2,286; 95% CI 1,380-3,788). Mothers in Sumatra region had a 1,610 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR 1.610; 95% CI 1.011-2,565). Similarly, mothers in Java-Bali region who had a 1.773 times higher chance of exclusive breastfeeding than those in Kalimantan region (OR 1.773; 95% CI 1.114-2.822).

Table 3 presents that the variables of child's age, mother's education, occupation, economic status, number of antenatal care visits, early initiation of breastfeeding, and postnatal care visits had a relationship with exclusive breastfeeding. Children aged 0-1 month and 2-3 months in all regions, except Kalimantan ( $p > 0.05$ ), had a higher chance of exclusive breastfeeding than those aged 4-5 months. Mothers in Sumatra region who were secondary school graduates had a 1,772 times higher chance of exclusive breastfeeding than those with lower education (OR 1,772; 95% CI 1,077-2,916). Mothers in Java-Bali region who did not work had a 2,500 times higher chance of exclusive breastfeeding than those who worked (OR 2,500; 95% CI 1.591-3,928). Mothers with middle to upper economic status had a lower chance of exclusive breastfeeding compared to mothers with poorer economic status in Sumatra (OR 0.472; 95% CI 0.257-0.869) and the Java-Bali region (OR 0.415; 95% CI 0.230-0.746).

**Table 3. The Relationship between Independent Variables and The Practice of Exclusive Breastfeeding by Region in Indonesia**

Variables	Exclusive Breastfeeding																			
	Indonesia			Sumatera			Java-Bali			Nusa Tenggara			Kalimantan							
	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value				
	Lower	Upper		Lower	Upper		Lower	Upper	Lower	Upper		Lower	Upper		Lower	Upper				
<b>Maternal Age</b>																				
35-49	0.965	0.530	1.756	0.906	1.194	0.439	3.246	0.727	0.943	0.340	2.613	0.910	0.688	0.055	8.676	0.770	0.552	0.106	2.874	0.476
20-34	1.115	0.680	1.828	0.665	1.011	0.445	2.299	0.979	0.923	0.416	2.052	0.845	2.710	0.272	27.051	0.391	3.140	0.597	16.521	0.174
15-19	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Child's Age (Months)</b>																				
0-1	3.359	2.396	4.710	0.000	3.128	1.686	5.806	0.000	3.592	2.016	6.401	0.000	27.181	4.884	151.282	0.000	1.722	0.539	5.501	0.354
2-3	2.019	1.507	2.704	0.000	1.958	1.110	3.455	0.021	1.885	1.182	3.005	0.008	3.916	1.611	9.520	0.003	1.255	0.367	4.292	0.714
4-5	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Residence</b>																				
Rural	1.238	0.929	1.651	0.145	1.315	0.811	2.134	0.266	1.218	0.760	1.952	0.411	1.703	0.364	7.963	0.494	1.639	0.638	4.209	0.300
Urban	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Education</b>																				
Higher	1.460	0.919	2.319	0.109	1.371	0.590	3.187	0.462	1.575	0.695	3.571	0.276	2.150	0.491	9.410	0.305	3.543	0.531	23.621	0.188
Secondary	1.210	0.864	1.694	0.266	1.772	1.077	2.916	0.025	1.116	0.609	2.045	0.722	0.622	0.211	1.833	0.385	0.858	0.240	3.062	0.811
Primary	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Occupation</b>																				
Not Working	1.578	1.198	2.078	0.001	0.864	0.514	1.453	0.580	2.500	1.591	3.928	0.000	1.536	0.571	4.130	0.390	2.308	0.670	7.955	0.182
Working	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Economic Status</b>																				
Upper	0.662	0.457	0.958	0.029	0.802	0.443	1.453	0.466	0.571	0.301	1.083	0.086	0.763	0.153	3.808	0.739	1.783	0.347	9.171	0.484
Middle	0.481	0.341	0.678	0.000	0.472	0.257	0.869	0.016	0.415	0.230	0.746	0.003	1.190	0.125	11.355	0.878	0.659	0.190	2.287	0.507
Lower	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Parity</b>																				
>1	1.286	0.937	1.766	0.120	1.260	0.677	2.343	0.464	1.136	0.692	1.866	0.613	1.443	0.397	5.254	0.574	1.021	0.347	3.005	0.970
1	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Number of Antenatal Care Visits</b>																				
>=4	1.409	0.962	2.064	0.078	1.491	0.807	2.754	0.202	1.501	0.699	3.223	0.297	19.400	4.549	82.743	0.000	0.704	0.173	2.859	0.620
<4	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Place of Delivery</b>																				
Health Facilities	0.898	0.629	1.283	0.556	0.641	0.342	1.201	0.164	.972	.420	2.246	0.947	0.622	0.239	1.623	0.328	0.519	0.156	1.732	0.282
Non-Health Facilities	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Type of Delivery</b>																				
Vaginal	1.217	0.837	1.769	0.303	1.193	0.638	2.230	0.579	1.397	0.772	2.526	0.268	0.786	0.158	3.909	0.766	0.342	0.084	1.395	0.133
Caesar	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Early Initiation of Breastfeeding</b>																				
<1 Hour	1.693	1.308	2.191	0.000	1.602	0.997	2.572	0.051	1.608	1.044	2.478	0.031	1.390	0.516	3.744	0.511	4.792	1.738	13.213	0.003
>1 Hour	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Postnatal Care Visits within 2 Months</b>																				
No	0.974	0.746	1.273	0.849	1.493	0.945	2.360	0.086	0.797	0.499	1.274	0.342	0.753	0.270	2.103	0.584	1.366	0.515	3.623	0.526
Yes	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.

**Table 3. The Relationship between Independent Variables and The Practice of Exclusive Breastfeeding by Region in Indonesia (continuation)**

Variables	Exclusive Breastfeeding											
	Sulawesi				Maluku				Papua			
	OR	95%CI		P Value	OR	95%CI		P Value	OR	95%CI		P Value
	Lower	Upper			Lower	Upper			Lower	Upper		
<b>Maternal Age</b>												
35-49	0.344	0.054	2.199	0.258	0.398	0.029	5.506	0.486	1.417	0.123	1.631	0.895
20-34	0.768	0.132	4.463	0.768	1.287	0.276	6.012	0.745	0.848	0.110	6.541	0.914
15-19	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Child's Age (Months)</b>												
0-1	2.035	0.876	4.726	0.098	<b>3.489</b>	<b>1.003</b>	<b>12.136</b>	<b>0.049</b>	4.948	0.564	43.391	0.142
2-3	<b>2.850</b>	<b>1.417</b>	<b>5.730</b>	<b>0.004</b>	<b>3.912</b>	<b>1.328</b>	<b>11.520</b>	<b>0.014</b>	<b>7.715</b>	<b>1.401</b>	<b>42.470</b>	<b>0.021</b>
4-5	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Residence</b>												
Rural	1.664	0.847	3.269	0.138	1.054	0.329	3.378	0.928	0.083	0.001	6.516	0.252
Urban	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Education</b>												
Higher	0.937	0.336	2.614	0.901	1.641	0.402	6.696	0.485	0.350	0.013	9.231	0.516
Secondary	1.522	0.691	3.352	0.295	1.506	0.429	5.279	0.517	1.012	0.175	5.850	0.989
Primary	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Occupation</b>												
Not Working	0.751	0.377	1.496	0.413	1.444	0.606	3.443	0.402	0.428	0.109	1.688	0.215
Working	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Economic Status</b>												
Upper	0.808	0.327	1.996	0.642	0.711	0.181	2.790	0.620	0.091	0.000	24.012	0.385
Middle	0.572	0.234	1.400	0.220	0.584	0.150	2.279	0.433	0.108	0.002	6.133	0.268
Lower	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Parity</b>												
>1	1.622	0.703	3.745	0.255	1.845	0.681	4.999	0.225	1.308	0.078	21.815	0.846
1	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Number of Antenatal Care Visits</b>												
>=4	0.991	0.417	2.355	0.984	1.807	0.589	5.547	0.296	0.966	0.121	7.710	0.973
<4	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Place of Delivery</b>												
Health Facilities	0.759	0.370	1.558	0.450	0.708	0.240	2.092	0.527	2.366	0.162	34.460	0.515
Non-health Facilities	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Type of Delivery</b>												
Vaginal	0.660	0.254	1.711	0.390	3.607	0.236	55.059	0.351	2.614	0.273	25.030	0.525
Caesar	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Early Initiation of Breastfeeding</b>												
<1 Hour	1.727	0.893	3.340	0.104	1.024	0.401	2.615	0.959	0.900	0.160	5.083	0.902
>1 Hour	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.
<b>Postnatal Care Visits within 2 Months</b>												
Yes	<b>0.432</b>	<b>0.224</b>	<b>0.830</b>	<b>0.012</b>	<b>0.407</b>	<b>0.179</b>	<b>0.924</b>	<b>0.032</b>	0.595	0.112	3.150	0.528
No	Ref.	.	.	.	Ref.	.	.	.	Ref.	.	.	.



## 1 DISCUSSION

2 This study shows that there are substantial variations in exclusive breastfeeding in all  
3 regions in Indonesia. This study reported that certain regions have diverse socio-economic,  
4 religious, cultural, and geographical conditions. Mothers living in Nusa Tenggara region had the  
5 highest prevalence of exclusive breastfeeding, while those in Kalimantan region was the lowest.  
6 The results of the binary logistic regression analysis revealed that all regions, except Maluku  
7 Islands and Papua, had significant differences in exclusive breastfeeding compared to Kalimantan  
8 region servings as a reference. However, the differences were not significant in Maluku Islands,  
9 Papua, and the Kalimantan regions. In other words, mothers who lived in Nusa Tenggara, Java-  
10 Bali, Sulawesi, and Sumatra regions had a higher chance of exclusive breastfeeding compared to  
11 those in Kalimantan regions.

12 West Nusa Tenggara was the province with the highest coverage of exclusive breastfeeding  
13 in Indonesia, even in the last 5 years [9]. West Nusa Tenggara province has implemented Early  
14 Breastfeeding Initiation (IMD) and exclusive breastfeeding programs since 2010. It also has  
15 initiated Regional Regulation No. 7 of 2011 concerning the Protection and Improvement of  
16 Maternal and Child Health which requires IMD and exclusive breastfeeding. This exclusive  
17 breastfeeding was even conducted before the enactment of Government Regulation of the Republic  
18 of Indonesia No. 33 of 2012 concerning Exclusive Breastfeeding. After the regional regulations  
19 were enacted, the regional government had to disseminate the information to the community and  
20 related parties, such as hospitals and health centers. It is recommended that health services should  
21 develop written policies to support exclusive breastfeeding, provide early initiation of breastfeeding  
22 services, and provide training for health workers to encourage and assist mothers to give exclusive  
23 breastfeeding either directly or indirectly, in maternity clinics or general hospitals [21].

24 This study also shows that mothers living in Kalimantan were less likely to exclusively  
25 breastfeed their babies than those living in Java-Bali known as urban islands. In general, people  
26 who lived in urban areas had a better education than those living in rural areas. For this reason,  
27 mothers living in urban areas tend to have a better access to health facilities and information, such  
28 as lactation consultation and support. [22,23].

29 Kalimantan regions had a lower rate of exclusive breastfeeding compared to other regions.  
30 Several studies conducted in Kalimantan showed that a strong predictor of non-exclusive  
31 breastfeeding was low education. Mothers were less aware of the benefits of exclusive  
32 breastfeeding, most of whom believed that additional food could make their babies grow faster.  
33 The regional government contributed to this unfortunate situation since guidelines, information,  
34 socialization on the exclusive breastfeeding were not promoted to local mothers. Even, sanctions  
35 for public operators who failed to support the exclusive breastfeeding facilities were not upheld. As  
36 a result, the implementation of exclusive breastfeeding in the Kalimantan regions was less optimum  
37 [24,25].

38 Various government policies related to exclusive breastfeeding have been established,  
39 including Law Number 36 of 2009, Article 128 paragraphs 2 and 3. The policies state that during  
40 breastfeeding, families, regional governments, and the community must fully support mothers by  
41 providing time and required facilities. Although some regions have followed up with these regional  
42 regulations, a few have ignored them. [26].

43 To date, the traditional practice of infant feeding among indigenous tribes is still quite  
44 high. In eastern Indonesia, babies who are only a few days old are often fed with liquid called sago  
45 solution as a nutritional intake. They are given mashed food when they are 2-3 months old [27–29].  
46 Another study stated that the Javanese tradition gives sugar solution to babies since they are a few  
47 days old [30], and Gayo people have a tradition of applying honey to the lips of newborn babies

48 [31]. This traditional practice, on the other hand, is a challenge for health workers who have to  
49 promote exclusive breastfeeding [32]. Women living in different areas with different cultural  
50 backgrounds and beliefs may have different nutritional behaviors, including the practice of  
51 exclusive breastfeeding [33]. Therefore, efforts to promote exclusive breastfeeding must consider  
52 the socio-cultural and environmental conditions of the target population.

53 This study shows that there was a significant relationship ( $p < 0.05$ ) between maternal  
54 education and exclusive breastfeeding in Sumatra region. Mothers who graduated from secondary  
55 school had a higher chance of exclusive breastfeeding than those with lower education. In line with  
56 previous studies, holding higher education degree tends to make mothers more likely to exclusively  
57 breastfeed their babies [34]. Higher education opens more access to information and thus allows  
58 mothers to think more rationally about the benefits of exclusive breastfeeding. Although it has a  
59 positive effect, higher education also opens wider access for mothers to work. In this study, the  
60 absence of a significant relationship between education and exclusive breastfeeding in other  
61 regions could cause constraints such as short maternity leave that requires mothers to return to  
62 work before the exclusive breastfeeding period ends [35].

63 In Java-Bali, mothers who did not work had a higher chance of exclusive breastfeeding  
64 than those who worked. This is in line with several previous studies which found a positive  
65 relationship between non-working mothers and exclusive breastfeeding [13,35–37]. Mothers who  
66 do not work tend to have more time with their babies. On the other hand, working mothers tend to  
67 have less time with their babies due to work, resulting in shorter breastfeeding durations which in  
68 turn inhibits exclusive breastfeeding [35]. In this case, working mothers face several challenges  
69 such as conflicting commitments at work, limited support from the workplace, and a lack of  
70 breastfeeding facilities [38]. It may be caused the women's ability to balance their family and  
71 work- women breastfeed for as long as possible while also working to provide an income for  
72 themselves and their children.

73 This study shows that it is important to provide breastfeeding support to working mothers.  
74 The workplace should provide a private and safe place (such as a lactation room) for pumping,  
75 equipment needed for milk preservation, and breastfeeding breaks. In addition, previous studies  
76 have shown that longer maternity leave contributes to a longer duration of exclusive breastfeeding  
77 among working mothers [38,39].

78 Mothers from low socioeconomic groups in Sumatra and Java-Bali were more likely to  
79 give exclusive breastfeeding than those from upper middle economic groups. This finding is in line  
80 with several previous studies [40–42]. This finding, however, surprisingly showed low-income  
81 families have more limited resources to buy alternative foods for their babies and it causes  
82 breastfeeding the only option. In addition, high-income households have a better access to  
83 education and hence a greater opportunity for professional work. Meanwhile, working mothers tend  
84 to be less likely to give exclusive breastfeeding, especially if they do not receive support from the  
85 workplace [41,42]. However, this study is not in line with several previous studies conducted in  
86 Somali and Ethiopia which stated that high-income households tend to have a positive relationship  
87 with exclusive breastfeeding because they have a greater chance of being exposed to various media  
88 and better knowledge of exclusive breastfeeding [43,44].

89 In this study, mothers in Nusa Tenggara who had  $\geq 4$  times antenatal care visits during  
90 their pregnancy had a higher chance of exclusive breastfeeding than those who had  $\leq 4$  times  
91 antenatal care visits [45]. A study conducted in Sweden found that, during antenatal care visits,  
92 most mothers asked for knowledge about the physiology of breastfeeding, signs of adequate milk  
93 supply, and ways to increase milk supply [46]. A qualitative study in Bhutan showed that one of  
94 the reasons why mothers use formula milk is the belief that they are not producing sufficient breast

95 milk [47]. Therefore, counseling sessions during antenatal care visits are important to increase self-  
96 confidence and positive views about breastfeeding. Previous studies have shown that mothers who  
97 live in Nusa Tenggara have a 4,365 times higher chance ( $\geq 4$ ) to make antenatal care visits than  
98 those in other regions [18].

99 In Java-Bali and Kalimantan, mothers who initiated early breastfeeding within  $\leq 1$  hour  
100 after delivery had a higher chance of exclusive breastfeeding than those who initiate within  $\geq 1$   
101 hour after delivery. This finding is in line with several previous studies [11,48]. The World Health  
102 Organization (WHO) explains that early initiation of breastfeeding can increase the chances of  
103 exclusive breastfeeding in 1-4 months after delivery [49]. Furthermore, this study shows that, in  
104 Sulawesi and Maluku, respondents who visited postnatal care within two months after delivery had  
105 a lower chance of exclusive breastfeeding. This may be due to the absence of breastfeeding  
106 counseling during postnatal care visits. In this study, the majority of mothers living in Maluku  
107 (64%) did not receive counseling about exclusive breastfeeding within the first two days after  
108 delivery. In line with the Indonesia Demographic and Health Survey 2017, this study also shows  
109 that, from several types of newborn care, only 48-59% of mothers received information about  
110 warning signs and breastfeeding counseling [8]. It may be the factors that increase the risk of low  
111 supply.

112 The strength of this study lies in the use of secondary data from the Indonesia  
113 Demographic and Health Survey 2017 which covers all data across regions in Indonesia. The use of  
114 a large sample and a nationally representative sampling procedure method made it possible to  
115 generalize the results of this study to all mothers throughout Indonesia. In addition, data weighting  
116 was also carried out during the analysis process to adjust disproportionate sampling techniques.  
117 This survey had a high response rate of 97.8% [8]. Data were collected by skilled personnel using  
118 standardized questionnaires to ensure the success of the survey and to obtain qualified data. Apart  
119 from the strengths, this study also had some limitations, some of which was the use of a small  
120 number of variables related to exclusive breastfeeding. Other variables include sex of the infant,  
121 birth weight, birth spacing, cultural perceptions, beliefs, and family support. Another limitation was  
122 the use of a cross-sectional analytical design that merely studied the relationships between  
123 variables without considering the cause-and-effect relationships between variables. Finally,  
124 exclusive breastfeeding was measured based on a history of information about food and drink given  
125 to infants aged 0-5 months in the last 24 hours before the survey was conducted without  
126 considering the previous period. As a result, this may lead to a misclassification bias of exclusive  
127 breastfeeding.

## 129 CONCLUSION

130 This study shows substantial variations in proportions and determinants of exclusive  
131 breastfeeding across all regions in Indonesia. -Nusa Tenggara region had the highest proportion of  
132 exclusive breastfeeding, while Kalimantan region had the lowest one. The factors associated with  
133 exclusive breastfeeding varied widely in all regions, where the child's age was the only common  
134 factor associated with exclusive breastfeeding, except Kalimantan region. Other variables related to  
135 exclusive breastfeeding were secondary education in -Sumatra region, occupation in Java-Bali  
136 region, economic status in Sumatra and Java-Bali regions, early initiation of breastfeeding in Java-  
137 Bali and Kalimantan regions, postnatal care visits in Sulawesi and Maluku Island regions, and  
138 antenatal care visits in Nusa Tenggara region. Appropriate policies and strategies are needed to  
139 increase exclusive breastfeeding in all regions to reduce disparity in exclusive breastfeeding.  
140 Optimizing existing policies, the central government can impose strict sanctions on local

141 governments and public facility operators who do not implement exclusive breastfeeding  
142 regulations. Future researchers are expected to examine variables that have not been covered in this  
143 study. These variables include sex of the infant, birth weight, birth spacing, cultural perceptions,  
144 beliefs, and family support for exclusive breastfeeding.

#### 145 **Ethical approval**

146 We used secondary data. Ethical clearance was obtained in the 2017 IDHS from the National ethics  
147 committee. Respondents provided written approval for their involvement in the study. We have  
148 obtained permission to use the data through the following website: [https://dhsprogram.com/  
149 data/new-user-registration.cfm](https://dhsprogram.com/data/new-user-registration.cfm).

150

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#### 153 **Competing Interest**

154 The author declares that no conflicts of interest

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## TABLE OF RESPONSES TO REVIEWER(S)' COMMENTS

Dear editor & reviewer

Thank you for valuable comments. We really appreciate all comment for improvement our paper. Here below our response.

### Editor comment:

Could you please revise based on the reviewer's feedback below, and also could you please ask a native English speaker to check the article for language issues.

Response:

Thank you for the advise. We have proofread our manuscript

NO	REVIEWER COMMENTS	RESPONSES TO COMMENTS
1.	Lines 17-21: It says here that the % of exclusively breastfed children increased by 11% between 2012 and 2017, from 42% to 52%. This is a 10% increase, not 11%. Please also clarify that means the initiation of exclusive breastfeeding at birth. It also says that the % of children not exclusively breastfed increased from 11% to 12% in the same period - are you referring to partial/combo feeding here?	Thank you for the correction. We have revised our statement that "the coverage of exclusive breastfeeding for children under six months old increased by 10% in the last 5 years, from 42% in 2012 to 52% in 2017" See line 11-13 Exclusive breastfeeding is the process of feeding infants during the first 1 hour after giving birth. See line 10-11 the % of children not exclusively breastfed increased from 11% to 12% in the same period refers to children who did not get breast milk at all see line 13-14
2.	Line 23: To acknowledge the achievement of 50% exclusive breastfeeding initiation at birth, you could expand a little more. Were there any notable social developments during this time that contributed to the success of the strategy?	We have added information about some regulations implemented support exclusive breastfeeding in Indonesia See line 17-19
3.	Line 52: Is there a word missing after "development"?	We have erased the word "development"
4.	Methods Lines 15-20: Can you clarify the % of mothers excluded from the study by category, e.g. 30% excluded due to incomplete data, 5% due to twins,	We have added the information about 10% was excluded due to incomplete data, 1% was due to twins and 1% was the missing data.  See line 64-65



	etc.	
5.	Results Line 5: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See line 131
6.	Table 1: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See table 1
7.	Table 3: Change "normal" delivery to vaginal delivery.	We have changed "normal" delivery to vaginal delivery See table 3
8	Discussion Line 4: Change the word "proves". It's a cross-sectional study - causation cannot be determined.	We have revised our statement to this study reported that certain regions have diverse socio-economic, religious, cultural, and geographical conditions. See line 3-4
9	Lines 29-30: The statement that working mothers struggle to balance work and family life is not referenced. It could also be argued that the balance currently achieved - where women breastfeed for as long as possible while also working to provide an income for themselves and their other children - is the best balance that can be currently achieved.	We have added this information in discussion: It may be caused the women's ability to balance their family and work- women breastfeed for as long as possible while also working to provide an income for themselves and their children. See line 70-72
10	Line 20: You mention "danger signs". Are these the factors that increase the risk of low supply?	Yes, we have describe the information in discussion: it might be caused by one of factor from increase the risk of low supply See line 110-111



Haerawati Idris &lt;haera@fkm.unsri.ac.id&gt;

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