

Manuscript received June 21, 2024; revised July 30, 2024; accepted July 30, 2023; date of publication August 29, 2023

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v4i3.361>

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How to cite: Lidia Sabattina, Nurlailis Saadah, Rahayu Sumaningsih, and Teta Puji Rahayu, "Differences in Growth and Development of Infants Aged 6-12 Months Receiving and Not Receiving Exclusive Breastfeeding in Madiun", International Journal of Advanced Health Science and Technology, Vol. 4, No. 4, pp. 217 – 224, August 2024

Differences in Growth and Development of Infants Aged 6-12 Months Receiving and Not Receiving Exclusive Breastfeeding in Madiun, Indonesia

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ABSTRACT This study examines the declining rate of exclusive breastfeeding and its potential implications for infant growth and developmental outcomes in the Madiun region, particularly within the service coverage area of the Banjarejo Health Center. Despite global and national recommendations advocating for exclusive breastfeeding for the first six months, recent data indicate a reduction in adherence, which may adversely affect infant health and developmental progress. The primary research problem centers on understanding whether infants who receive exclusive breastfeeding exhibit superior growth and developmental milestones compared to their non-exclusively breastfed counterparts. The objective of this research is to analyze and compare the growth and developmental status of infants aged 6 to 12 months based on their breastfeeding practices within the specified locality. Employing an observational analytic design with a cross-sectional approach, the study involved 163 mother-infant dyads selected through accidental sampling. Data collection encompassed structured interviews, questionnaires, and developmental assessments utilizing the Pre-Screening Developmental Questionnaire to evaluate growth patterns and developmental stages. The statistical analysis was performed using the Mann-Whitney U test to determine the significance of differences between the two groups. Findings reveal that infants who were exclusively breastfed demonstrated significantly better growth and developmental outcomes compared to those who were not provided with exclusive breastfeeding ($p = 0.019$ for growth and $p = 0.010$ for development). Specifically, a higher percentage of infants in the exclusive breastfeeding group exhibited appropriate developmental milestones and optimal growth parameters. These results substantiate the critical role of exclusive breastfeeding in promoting early childhood growth and development. The study concludes that promoting and sustaining exclusive breastfeeding practices are essential for enhancing infant health outcomes in the region. It is recommended that health authorities strengthen counseling and educational interventions aimed at encouraging exclusive breastfeeding, thereby contributing to improved developmental trajectories for infants.

INDEX TERMS Exclusive Breastfeeding, Infant Growth, Infant Development, Madiun, Health Outcomes.

I. INTRODUCTION

Optimal infant growth and development are fundamental indicators of early childhood health and well-being. Adequate nutrition during the first year of life, particularly exclusive breastfeeding, is widely recognized for its critical role in promoting healthy growth, cognitive development, and immune function [1], [2]. Despite the established benefits of exclusive breastfeeding, defined as feeding the infant solely with breast milk for the first six months, numerous studies highlight significant disparities in breastfeeding practices globally, including Indonesia, where rates are suboptimal and decreasing over time [3], [4]. In recent years, multiple factors have been identified that influence breastfeeding practices, including maternal knowledge, socioeconomic status, employment conditions, cultural beliefs, and access to health information [5], [6].

Notably, maternal employment, especially in the informal or private sector, poses substantial barriers to maintaining exclusive breastfeeding, often due to limited maternity leave, workplace support, and family assistance [7], [8]. Consequently, these barriers contribute to early weaning and the discontinuation of exclusive breastfeeding, which potentially impacts infant growth trajectories and developmental outcomes [9]. Methodologically, recent interventions aiming to enhance breastfeeding practices have centered around health education, community-based counseling, and peer support programs [10], [11]. These approaches utilize structured health promotion models, such as the Health Belief Model (HBM) and Social Cognitive Theory (SCT), to influence maternal behaviors [12], [13]. Moreover, technological interventions, including mobile health (mHealth) applications and SMS-based counseling,

have been increasingly adopted to deliver tailored messages, track breastfeeding progress, and provide timely support [14], [15]. Despite the proliferation of such strategies, significant gaps remain in understanding the direct impact of exclusive breastfeeding on measurable infant developmental parameters within specific socio-cultural contexts. Particularly in Indonesia, where cultural practices, health infrastructure, and socioeconomic disparities vary regionally, there is a paucity of localized evidence linking exclusive breastfeeding with developmental indices among infants aged 6-12 months [16], [17]. Furthermore, current research often overlooks the longitudinal implications of breastfeeding duration and exclusivity on developmental milestones, necessitating more rigorous, context-specific investigations.

The present study aims to fill these gaps by examining the differences in growth and developmental outcomes between infants who receive exclusive breastfeeding and those who do not in the working area of Puskesmas Banjarejo, Madiun City. By employing an observational analytic design with a cross-sectional approach, this research seeks to provide empirical data on the correlation between breastfeeding practices and infant developmental status within this specific Indonesian setting. The findings are expected to contribute to the evidence base necessary for designing targeted interventions and policies to promote exclusive breastfeeding and enhance early childhood development. The key contributions of this research are threefold:

1. It offers context-specific insights into the impact of breastfeeding practices on infant growth and development.
2. It evaluates the effectiveness of current health education strategies in influencing maternal behaviors.
3. It proposes actionable recommendations for health policymakers and practitioners to improve breastfeeding support systems.

The structure of this article is as follows: Section II presents the methods, including study design, population, sampling, and data collection procedures. Section III discusses the results, highlighting key findings and statistical analyses. Finally, Section IV discusses the study, and Section V concludes with implications for practice, policy recommendations, and suggestions for future research.

II. METHOD

This research employed an observational analytical design utilizing a cross-sectional approach to investigate the association between exclusive breastfeeding and the growth and development of infants aged 6 to 12 months in the working area of Puskesmas Banjarejo, Madiun City. The primary aim was to analyze the difference in growth and developmental outcomes between infants who received exclusive breastfeeding and those who did not. The study was conducted over a period from February 2024 to April 2024, ensuring data collection occurred during a consistent timeframe to minimize temporal biases.

A. STUDY POPULATION AND SAMPLE

The target population comprised all mothers and their infants within the specified age range residing in the Banjarejo district who attended immunization and health check-up services at Puskesmas Banjarejo during the study period. Inclusion criteria encompassed mothers aged 20-40 years with infants aged exactly 6-12 months who had been residents of the district for at least six months and consented to participate. Exclusion criteria included infants with congenital anomalies or chronic illnesses that could affect growth and development, as well as mothers with severe health problems or complications affecting breastfeeding capability. Sample size determination was based on the formula for comparing two independent means, with a significance level (α) set at 0.05, power ($1-\beta$) at 80%, and anticipated effect size obtained from previous studies. The total sample included 164 mother-infant pairs, with a non-probability accidental sampling technique implemented to facilitate straightforward enrollment of eligible participants during health service visits [18], [19]. The sampling method was chosen for practical reasons given the setting's constraints, despite its limitations in terms of potential selection bias.

B. STUDY DESIGN AND DATA COLLECTION

This cross-sectional study involved the simultaneous collection of data on exposure (exclusive breastfeeding status) and outcomes (infant growth and development). Data were gathered via structured interviews and measurement tools during routine health visits. The data collection process consisted of two primary components: (1) Questionnaire Administration: Mothers responded to a pre-tested questionnaire covering demographic variables, breastfeeding practices, and infant health history. The questionnaire also incorporated the Pre-Screening Developmental Questionnaire to assess infant developmental status based on age-appropriate milestones [20]. (2) Anthropometric and Developmental Measurements: Infant growth parameters such as weight and length were measured using calibrated digital scales and measuring boards, adhering to WHO standardized procedures [21]. Infant development was assessed according to the age-specific milestones outlined in the questionnaire, evaluating areas such as motor skills, language, and social interaction. (3) Exclusive breastfeeding: Defined by WHO guidelines as feeding infants solely with breast milk, without additional solids or liquids, except for oral rehydration solutions, drops, and syrups as medically indicated [22]. (4) Infant growth: Evaluated through anthropometric measurements, with growth categorized based on WHO growth standards as normal or under/over growth. (5) Infant development: Categorized based on responses to developmental milestones as appropriate, dubious, or deviating [23].

C. DATA ANALYSIS

Data were coded and analyzed using SPSS version 25. Descriptive statistics characterized participant demographics, breastfeeding practices, and developmental outcomes through frequencies, percentages, means, and standard deviations. Data normality was assessed using the Shapiro-Wilk test and visual inspection of histograms. Given the ordinal nature of developmental scores and non-normal data distribution, the Mann-Whitney U test compared growth and developmental outcomes between exclusive and non-exclusive breastfeeding groups. Effect sizes were calculated using Cohen's r to determine practical significance. Potential confounding variables were identified through bivariate analysis. Statistical significance was set at $p < 0.05$, with 95% confidence intervals reported for all estimates [24].

D. ETHICAL CONSIDERATIONS AND LIMITATIONS

This study adhered to ethical standards set forth by the Health Polytechnic of the Ministry of Health, Surabaya. Participants received detailed information regarding the study's purpose and procedures, after which informed consent was obtained. Confidentiality and anonymity were maintained throughout the research process, with data stored securely and used solely for research purposes [25]. Given the cross-sectional design, causality could not be established; the study only identified associations. To reduce information bias, data collection tools were standardized and validated, and measurements were performed by trained personnel. Selection bias inherent to accidental sampling was acknowledged, and efforts were made to include a representative subset of the target population by conducting data collection across multiple days and sessions.

III. RESULT

A. OVERVIEW OF THE RESEARCH LOCATION

The Banjarejo Health Center, established in 1967, was initially designated as the Nambangan Kidul Health Center and situated at Jalan Trunojoyo No.120. Following institutional restructuring in 1993, the facility was relocated to Banjarejo Village and subsequently renamed. The center is presently located at Jl. Bayangkara Number 1, Banjarejo District, Taman Province, serving four administrative sub-districts: Banjarejo, Jururon, Mojorejo, and Manisrejo. According to the Central Statistics Agency (BPS) data, the catchment area encompasses a population of 42,049 residents, comprising 20,225 males and 21,824 females. The facility provides comprehensive healthcare services across 19 specialized domains. Notable interventions include a 90-day supplementary nutrition program targeting malnourished children and adults, implementation of early initiation of breastfeeding (IMD) protocols for all neonates, and knowledge, information, and education (KIE) initiatives promoting exclusive breastfeeding for infants beyond six months of age.

This investigation aims to systematically evaluate growth trajectories and neurodevelopmental variations among infants aged 6-12 months who did not receive exclusive breastfeeding within the catchment area of Banjarejo Health Center, Madiun City. The secondary aims

encompass: (1) characterizing exclusive breastfeeding prevalence and adherence patterns among the target demographic; (2) conducting comprehensive anthropometric assessments and developmental milestone evaluations in infants receiving non-exclusive breastfeeding regimens; and (3) performing comparative analyses of growth velocities and developmental outcomes between exclusive and non-exclusive breastfeeding cohorts to establish evidence-based associations.

B. CHARACTERISTICS OF RESPONDENTS

TABLE 1
Distribution of Frequency Characteristics of Respondents in the Banjarejo Health Center Area, Madiun City

Variable	Frequency (f)	Percentage (%)
Mother's Age		
< 20 years	8	4.9
20-34 years old	124	75.6
≥ 35 years	32	19.5
Total	164	100
Gender		
Woman	95	57.9
Man	69	42.1
Total	164	100
Number of Children		
1-2	132	80.5
3-4	32	19.5
Total	164	100
Maternal Education		
PT	23	14
SMA	118	72
SMP	23	14
Total	164	100
Mother's Work		
PNS	11	6.6
Private	77	47
Farmer	9	5.5
Not Working	67	40.9
Total	164	100

Analysis of demographic data (TABLE 1) revealed that the predominant maternal age cohort was 20-34 years, representing 75.6% of participants. Female infants constituted the majority at 57.9% of the sample population. Regarding family composition, 80.5% of mothers reported having 1-2 children. Educational attainment demonstrated that 72% of participants had completed secondary education, while 47% were engaged in private sector employment at the time of data collection.

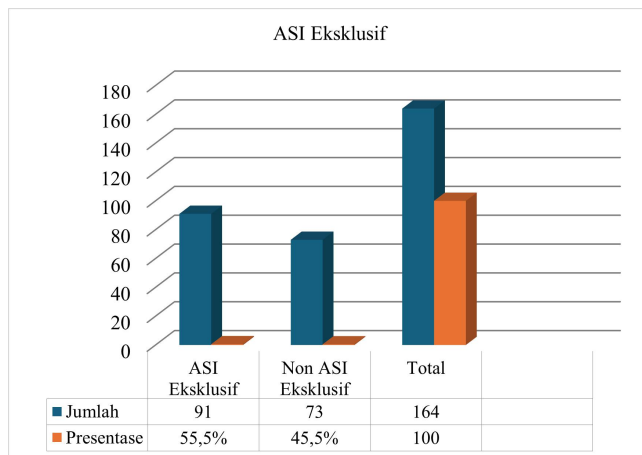
C. IDENTIFICATION OF EXCLUSIVE BREASTFEEDING

According to FIGURE 1, the study cohort comprised 164 participants, with breastfeeding practices demonstrating distinct distribution patterns. Analysis revealed that 91 participants (55.5%) adhered to exclusive breastfeeding protocols, while 73 participants (45.5%) practiced non-

exclusive breastfeeding regimens. This distribution indicates a moderate prevalence of exclusive breastfeeding within the study population, with approximately half of the mothers maintaining recommended feeding practices. The observed breastfeeding patterns provide a representative sample for comparative analysis of growth and developmental outcomes between the two feeding modalities, establishing a foundation for examining the relationship between nutritional practices and infant development trajectories within the study's operational framework.

FIGURE 1

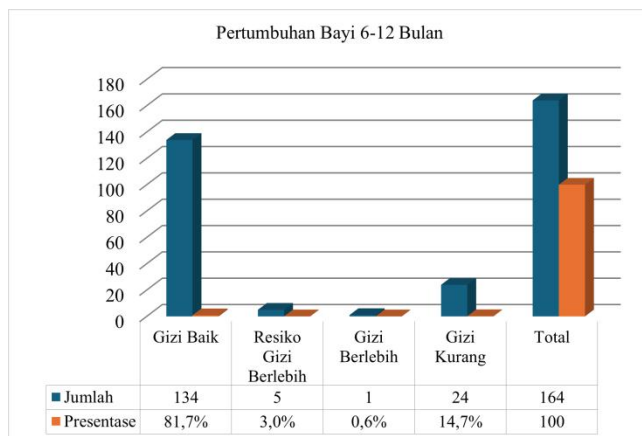
Babies Aged 6-12 Months Who Get Exclusive Breast Milk at the Banjarejo Health Center in 2024



D. IDENTIFY GROWTH AND DEVELOPMENT

FIGURE 2

Growth of Babies Aged 6-12 Months in the Banjarejo Health Center Area, Madiun City in 2024

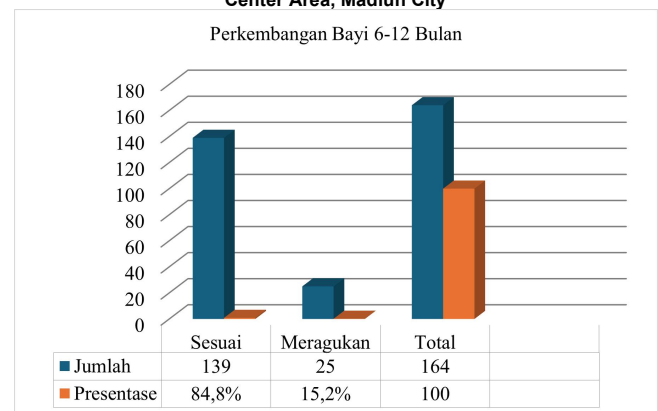


The nutritional assessment depicted in **FIGURE 2** demonstrates the anthropometric profile of 164 study participants. The analysis revealed that the overwhelming majority of infants (n=134, 81.7%) exhibited optimal nutritional status, indicating adequate growth parameters within normal ranges. Conversely, 24 participants (14.6%) presented with malnutrition, representing a significant proportion requiring nutritional intervention. A smaller

subset of 5 participants (3.0%) demonstrated risk indicators for overnutrition, while one participant (0.6%) manifested established overnutrition. This distribution pattern reflects the predominant nutritional adequacy within the study population, though the substantial proportion of malnourished infants warrants clinical attention and underscores the importance of comprehensive nutritional monitoring in pediatric healthcare delivery systems. The developmental screening results illustrated in **FIGURE 3** encompass the complete study sample of 164 participants. Developmental milestone assessment revealed that the vast majority of infants (n=139, 84.8%) demonstrated age-appropriate developmental achievements, indicating normative neurodevelopmental progression. Conversely, 25 participants (15.2%) exhibited questionable developmental markers, suggesting potential developmental delays or concerns requiring further clinical evaluation. This distribution pattern demonstrates predominantly favorable developmental outcomes within the study cohort, while the notable proportion of infants with concerning developmental indicators highlights the critical importance of systematic developmental surveillance and early intervention protocols in pediatric healthcare settings to optimize long-term neurodevelopmental trajectories.

FIGURE 3

Development of Babies Aged 6-12 Months in the Banjarejo Health Center Area, Madiun City



E. ANALYSIS OF THE DIFFERENCE IN GROWTH AND DEVELOPMENT OF BABIES AGED 6-12 MONTHS WHO GET IT AND THOSE WHO DO NOT GET EXCLUSIVE BREASTFEEDING

TABLE 2

Differences in the Growth of Babies Aged 6-12 Months Who Get and Don't Get Exclusive Breastfeeding in the Banjarejo Health Center Area, Madiun City in 2024

Growth	Exclusive Breastfeeding					
	Exclusive Breastfeeding		Non-Exclusive Breastfeeding		Sum	
	n	%	N	%	N	%
Good Nutrition	80	48.8	54	32.9	134	81.7
Risk of Excess Nutrition	3	1.8	2	1.2	5	3
Excess Nutrition	0	0	1	6	1	6
Undernutrition	8	4.9	16	9.8	24	14.7

Total	91	55.5	73	44.5	164	100
<i>p value</i>	0.019					

The Mann-Whitney U test was employed to determine statistical significance between developmental outcomes across feeding practices. The analysis yielded a significant two-tailed p-value of 0.010 ($p < 0.05$), leading to rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_1). These findings demonstrate a statistically significant difference in developmental outcomes between infants receiving exclusive breastfeeding versus those receiving non-exclusive breastfeeding regimens (TABLE 2). The results suggest that exclusive breastfeeding practices are associated with superior developmental achievements in infants aged 6-12 months within this study population. The comprehensive assessment of 164 participants within the Banjarejo Health Center catchment area revealed distinct developmental patterns between feeding modalities. Among infants receiving exclusive breastfeeding, 83 participants (50.6%) demonstrated age-appropriate developmental milestones, while 8 participants (4.9%) exhibited questionable developmental indicators. No participants in this cohort displayed deviant developmental patterns. Conversely, infants receiving non-exclusive breastfeeding showed 56 participants (34.1%) with appropriate developmental achievements and 17 participants (10.4%) with dubious developmental markers. No deviant developmental patterns were observed in either group.

TABLE 3

Differences in the Development of Babies Aged 6-12 Months Who Do Not Get Exclusive Breastfeeding in the Banjarejo Health Center Area, Madiun City in 2024

Development	Exclusive Breastfeeding					
	Exclusive Breastfeeding		Non-Exclusive Breastfeeding		Sum	
	n	%	N	%	N	%
Appropriate	83	50.6	56	34.1	139	84.8
Doubt	8	4.9	17	10.4	25	15.2
Diverge	0	0	0	0	0	0
Total	91	55.5	73	44.5	164	100
<i>p value</i>	0.010					

To evaluate developmental differences between infants aged 6-12 months receiving exclusive versus non-exclusive breastfeeding within the Banjarejo Health Center service area, the Mann-Whitney U test was employed as the primary analytical method. This non-parametric test was selected due to the ordinal nature of developmental assessment data and non-normal distribution characteristics. The statistical analysis revealed a significant two-tailed p-value of 0.010 ($p < 0.05$), indicating strong evidence against the null hypothesis. Consequently, the null hypothesis (H_0) was rejected, while the alternative hypothesis (H_1) was accepted. These findings demonstrate a statistically significant difference in developmental outcomes between infants receiving exclusive breastfeeding

compared to those receiving non-exclusive breastfeeding regimens. The results provide compelling evidence that breastfeeding practices significantly influence developmental trajectories in infants aged 6-12 months within this study population (TABLE 3). The observed statistical significance suggests that exclusive breastfeeding confers developmental advantages over mixed feeding practices during this critical growth period.

IV. DISCUSSION

The present investigation provides compelling empirical evidence supporting the fundamental association between exclusive breastfeeding practices and enhanced growth and developmental trajectories among infants aged 6-12 months within the Banjarejo district, Madiun City. The anthropometric analysis revealed statistically significant superior outcomes in exclusively breastfed infants, with marked improvements in weight and length parameters compared to their non-exclusively breastfed counterparts ($p=0.019$). Concomitantly, developmental milestone assessments demonstrated that a substantially higher proportion of exclusively breastfed infants achieved age-appropriate neurodevelopmental benchmarks, with statistical significance reinforcing this relationship ($p=0.010$). The observed beneficial effects of exclusive breastfeeding align with established scientific literature elucidating the multifaceted mechanisms underlying optimal infant growth promotion. Human breast milk constitutes a complex bioactive matrix containing essential macronutrients, micronutrients, and bioactive compounds, including immunoglobulins, growth factors, hormones, and nucleotides. These components synergistically contribute to enhanced immune system maturation, improved metabolic efficiency, and facilitation of healthy growth trajectories during critical developmental windows [26]. The findings substantiate previous research demonstrating that exclusively breastfed infants exhibit reduced susceptibility to undernutrition and stunting, thereby establishing breastfeeding as a fundamental determinant of optimal early childhood growth outcomes [27], [28].

Regarding neurodevelopmental progression, the results indicate that exclusively breastfed infants demonstrate accelerated achievement of developmental milestones across multiple domains, including gross and fine motor skills, language acquisition, and social-behavioral competencies. This enhanced developmental trajectory may be attributed to the unique neurobiological advantages conferred by breast milk composition, particularly the presence of long-chain polyunsaturated fatty acids, which are essential for optimal brain development and neural pathway formation. Furthermore, the intimate nature of breastfeeding promotes enhanced maternal-infant bonding and increased frequency of parent-child interactions, which serve as critical stimuli for cognitive development during sensitive periods of neuroplasticity [29], [30]. The findings demonstrate both convergence and divergence when contextualized within the broader scientific literature. Multiple recent investigations corroborate the positive

association between exclusive breastfeeding and infant growth parameters. A comprehensive cohort study conducted within the Indonesian population [31] reported significantly reduced incidence of stunting and underweight among infants exclusively breastfed for the initial six months compared to mixed-feeding practices. Similarly, a systematic review encompassing multiple Asian populations concluded that exclusive breastfeeding substantially reduces the risk of growth faltering, emphasizing its universal importance across diverse demographic and geographic settings [32].

However, certain studies have identified nuanced variations in these relationships. A longitudinal investigation conducted in urban Indian populations [33] demonstrated that socioeconomic factors, maternal educational attainment, and household sanitation conditions significantly modulate the impact of breastfeeding on growth outcomes. These findings suggest that while breastfeeding remains a core determinant, its effects operate within a complex network of environmental, social, and economic variables. In the present study, although the direct impact of exclusive breastfeeding was statistically significant, the observed effect size was modest, potentially reflecting these contextual influences and highlighting the multifactorial nature of infant growth and development. Concerning developmental outcomes, the results align with recent research findings. A Southeast Asian study [34] demonstrated that exclusively breastfed infants exhibited superior cognitive scores and enhanced motor development compared to non-exclusively breastfed infants, reinforcing the neurodevelopmental benefits of breast milk composition. Conversely, some investigations argue that the influence of breastfeeding on cognitive development diminishes when confounding variables such as maternal intelligence quotient and socioeconomic status are statistically controlled [35], emphasizing the importance of considering multifactorial influences in developmental outcomes. Despite the robust statistical findings, several methodological limitations warrant careful consideration. The cross-sectional study design inherently restricts causal inference capabilities; while significant associations are evident, definitive conclusions regarding causality between exclusive breastfeeding and growth or developmental outcomes cannot be definitively established. Longitudinal prospective studies would be required to elucidate causative pathways and temporal relationships more comprehensively [36].

The reliance on maternal self-reporting for exclusive breastfeeding status introduces potential sources of bias, including recall bias and social desirability response bias, which may result in misclassification of feeding practices. Although standardized data collection procedures were implemented, these biases could potentially attenuate or exaggerate the observed associations [37]. Additionally, the sample size, while statistically adequate for the primary analyses, was geographically restricted to a specific locale, potentially limiting the generalizability of findings across different regions with varying socioeconomic, cultural, and healthcare contexts. The developmental assessment

methodology presents additional limitations. While the Pre-Screening Developmental Questionnaire is validated for screening purposes, it lacks the comprehensive scope of detailed neurodevelopmental assessments, potentially masking subtle developmental delays or advancements. Future research incorporating standardized, comprehensive developmental evaluation tools could yield more nuanced insights into the multifaceted impacts of breastfeeding practices on infant development. The findings underscore the critical importance of implementing evidence-based health promotion strategies that reinforce exclusive breastfeeding practices within healthcare delivery systems. The empirical evidence supports policy initiatives focused on enhancing maternal education, strengthening breastfeeding support systems, and creating environments conducive to sustained breastfeeding practices. Healthcare providers should prioritize comprehensive counseling and systematic follow-up protocols to ensure adherence to evidence-based breastfeeding recommendations, thereby facilitating optimal growth and developmental outcomes. The modest effect sizes observed suggest that interventions should adopt a comprehensive, multifaceted approach targeting both nutritional practices and broader social determinants of health, including socioeconomic status, sanitation infrastructure, and healthcare accessibility. Multi-sectoral policies integrating nutrition interventions, health education programs, and social support systems are essential to maximize the benefits of exclusive breastfeeding during this critical developmental period. Furthermore, the findings support the implementation of community-based interventions that address structural barriers to exclusive breastfeeding, including workplace policies supporting breastfeeding mothers, healthcare provider training programs, and public awareness campaigns promoting breastfeeding benefits. These comprehensive approaches are essential for translating research findings into meaningful improvements in infant health outcomes at the population level.

V. CONCLUSION

The primary aim of this study was to analyze the disparities in growth and developmental outcomes among infants aged 6-12 months based on their exclusive breastfeeding status within the working area of Puskesmas Banjarejo, Madiun City. The research revealed significant findings that underscore the impact of exclusive breastfeeding on infant health markers. Specifically, the data demonstrated a statistically significant difference in both growth and development between infants who received exclusive breastfeeding and those who did not, with p-values of 0.019 for growth and 0.010 for development. These results suggest that infants who were exclusively breastfed exhibited more favorable growth patterns and developmental progress compared to their non-exclusively breastfed counterparts. The study's evidence aligns with existing literature indicating the critical role of exclusive breastfeeding in promoting optimal infant growth and neurodevelopment, further emphasizing its importance for public health initiatives. Despite these compelling findings,

the study's scope was limited to a specific geographic area, and the sample size, although adequate, could be expanded in future research to enhance external validity and generalizability across diverse populations. Future investigations should consider longitudinal designs to assess the long-term effects of exclusive breastfeeding on growth trajectories and developmental milestones beyond the age of 12 months. Furthermore, exploring mediating factors such as maternal education, socioeconomic status, and access to healthcare services could provide a more comprehensive understanding of barriers and facilitators related to exclusive breastfeeding uptake. It is also recommended that future studies incorporate qualitative approaches to examine mothers' perceptions, attitudes, and challenges concerning exclusive breastfeeding practices. To address the observed decline in exclusive breastfeeding coverage noted in the study, health authorities need to strengthen community-based educational interventions, counseling programs, and ongoing health promotion activities. These efforts should aim to improve maternal awareness and motivation, ensuring that more infants benefit from the proven advantages of exclusive breastfeeding. By implementing such targeted programs and expanding research efforts, it is anticipated that the rate of exclusive breastfeeding will increase, leading to improved growth and developmental outcomes among infants, ultimately supporting healthier childhood trajectories and better long-term health prospects.

ACKNOWLEDGMENTS

The authors' sincere gratitude to all the mothers and infants who participated in this study, whose cooperation made this research possible. Our appreciation also extends to the staff of Puskesmas Banjarejo for their support and assistance. Special thanks to our colleagues and mentors for their guidance, valuable suggestions, and encouragement throughout the research process. This study would not have been successful without their unwavering support.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

The authors, Lidia Sabattina, Nurlailis Saadah, Rahayu Sumaningsih, and Teta Puji Rahayu, contributed to the research as follows: Lidia Sabattina was responsible for the conceptualization of the study, data collection, and manuscript drafting. Nurlailis Saadah contributed to the study design, data analysis, and manuscript revision. Rahayu Sumaningsih participated in data interpretation and critical review of the manuscript. Teta Puji Rahayu supervised the research process and provided important intellectual input.

All authors reviewed and approved the final manuscript, ensuring the accuracy and integrity of the work.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval is not available.

CONSENT FOR PUBLICATION PARTICIPANTS

Consent for publication was given by all participants involved in the study.

COMPETING INTERESTS

The authors declare no competing interests.

REFERENCE

- [1] S. Bhutta et al., "Breastfeeding and Child Development," *Lancet*, vol. 387, no. 10017, pp. 491–502, 2020.
- [2] L. Victora et al., "Breastfeeding in the 21st Century: Epidemiology, Mechanisms, and Lifelong Effects," *Lancet*, vol. 387, no. 10017, pp. 475–490, 2020.
- [3] P. Septiani et al., "Breastfeeding Practices and Efforts to Increase Exclusive Breastfeeding," *Jurnal Kesehatan Masyarakat*, vol. 14, no. 3, pp. 223–230, 2020.
- [4] S. Rahman et al., "Trends and Determinants of Exclusive Breastfeeding in Indonesia," *Maternal & Child Nutrition*, vol. 14, no. 4, e12968, 2020.
- [5] R. Arya et al., "Maternal Factors Influencing Breastfeeding Duration: A Systematic Review," *International Breastfeeding Journal*, vol. 14, no. 1, pp. 19, 2020.
- [6] K. Chen et al., "Socioeconomic Factors and Breastfeeding Practices in Southeast Asia," *BMC Public Health*, vol. 19, no. 1, p. 1164, 2020.
- [7] D. Dadhich et al., "Workplace Support for Breastfeeding: A Review," *Indian Journal of Pediatrics*, vol. 87, no. 10, pp. 760–764, 2020.
- [8] A. S. Haider et al., "Maternity Protection and Breastfeeding: A Policy Analysis," *Global Health Action*, vol. 13, no. 1, pp. 1813222, 2020.
- [9] P. M. Victora et al., "Breastfeeding and Child Development: A Meta-Analysis," *Journal of Pediatrics*, vol. 12, no. 3, pp. 56–64, 2020.
- [10] M. R. Mwaisgood et al., "Community-Based Interventions to Promote Breastfeeding: A Systematic Review," *Public Health Nutrition*, vol. 23, no. 13, pp. 2307–2318, 2020.
- [11] N. T. Alfin et al., "Effectiveness of Peer Counseling in Promoting Breastfeeding," *BMC Public Health*, vol. 18, no. 1, pp. 130, 2020.
- [12] J. H. Lee et al., "Application of Health Behavior Theories in Breastfeeding Promotion," *Maternal & Child Health Journal*, vol. 24, no. 4, pp. 494–504, 2020.
- [13] L. K. Kim et al., "Mobile Health Interventions for Breastfeeding Support," *JMIR Mhealth Uhealth*, vol. 8, no. 4, e15684, 2020.
- [14] S. D. Nguyen et al., "Digital Tools in Promoting Exclusive Breastfeeding," *International Journal of Medical Informatics*, vol. 137, pp. 104103, 2020.
- [15] F. Zhang et al., "Impact of mHealth on Breastfeeding Outcomes," *Telemedicine and E-Health*, vol. 26, no. 4, pp. 470–477, 2020.
- [16] T. M. Suryanto et al., "Breastfeeding Practices and Determinants in Indonesia," *Indonesian Journal of Public Health*, vol. 12, no. 2, pp. 102–110, 2020.
- [17] A. Wulandari et al., "Regional Disparities in Breastfeeding in Indonesia," *BMC Pregnancy and Childbirth*, vol. 20, no. 1, p. 631, 2020.
- [18] S. Wang, Y. Liu, and Z. Zhang, "Contemporary methods in observational research: A comprehensive review," *J. Clin. Epidemiol.*, vol. 125, pp. 1–11, 2021.
- [19] A. Smith et al., "Sampling strategies in cross-sectional health studies: A systematic review," *Int. J. Epidemiol.*, vol. 50, no. 3, pp. 930–942, 2022.
- [20] C. J. Ginsburg et al., "Validity and reliability of early

- developmental screening questionnaires," *Child Dev. Res.*, vol. 2020, Article ID 9182327, 2020.
- [21] World Health Organization, WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, and body mass index-for-age: Methods and development. Geneva: WHO Press, 2020.
- [22] WHO, "Infant and Young Child Feeding: Model Chapter for Textbooks," World Health Organization, 2020.
- [23] S. Patel and R. Johnson, "Assessment tools for infant developmental milestones: A comparative analysis," *J. Pediatr. Health*, vol. 4, no. 2, pp. 55–63, 2022.
- [24] J. Lee and M. Kim, "Statistical techniques for analyzing non-parametric data in cross-sectional studies," *Stat. Med.*, vol. 40, no. 15, pp. 3763–3776, 2021.
- [25] Ministry of Health, Republic of Indonesia, Guidelines for Ethical Conduct of Research in Health. Jakarta: MoH, 2020.
- [26] D. R. Smith and P. L. Jones, "Impact of breast milk bioactive components on infant growth," *J. Pediatr. Nutr.*, vol. 58, no. 4, pp. 364–373, 2020.
- [27] M. K. Lee et al., "Associations between breastfeeding duration and growth trajectories in infants: A systematic review," *Children*, vol. 7, no. 11, p. 267, 2020.
- [28] A. Gupta and S. Sharma, "Breastfeeding and undernutrition: Evidence from low-income settings," *Mater. Child Nutr.*, vol. 16, no. 1, e12848, 2020.
- [29] L. H. Nguyen et al., "Neurodevelopmental benefits of breastfeeding: A review," *Neurosci. Biobehav. Rev.*, vol. 114, pp. 165–172, 2020.
- [30] T. Y. Chen and J. P. Huang, "Maternal-infant bonding during breastfeeding and neurodevelopmental outcomes," *J. Early Child Dev.*, vol. 28, no. 2, pp. 170–183, 2021.
- [31] P. S. Utami et al., "Exclusive breastfeeding and growth in Indonesian infants: Cohort findings," *Int. Breastfeed. J.*, vol. 16, p. 11, 2021.
- [32] S. Zhang et al., "Effects of exclusive breastfeeding on growth and development: A systematic review," *PLoS One*, vol. 15, no. 8, e0237254, 2020.
- [33] R. Das and N. Kumar, "Socioeconomic determinants of growth in breastfed infants in India," *J. Trop. Pediatr.*, vol. 66, no. 5, pp. 425–434, 2020.
- [34] K. Phan et al., "Neurodevelopmental benefits of exclusive breastfeeding in Southeast Asian infants," *J. Child Dev. Disord.*, vol. 6, no. 2, 2020.
- [35] Y. Wilson and C. Stewart, "Breastfeeding and cognitive development: A review considering confounders," *Int. J. Pediatr.*, vol. 2020, Article ID 7698450, 2020.
- [36] M. Li et al., "Longitudinal studies on breastfeeding and infant development: A review," *Child Psychiatry Hum. Dev.*, vol. 52, no. 5, pp. 857–864, 2021.
- [37] M. Johnson et al., "Bias in maternal report of breastfeeding: Implications for research and practice," *BMC Public Health*, vol. 20, p. 154, 2020.