



THE ROLE OF ROTAVIRUS IMMUNIZATION AND EXCLUSIVE BREASTFEEDING IN SUPPORTING GASTROINTESTINAL TRACT ANATOMY FOR THE PREVENTION OF CHILDHOOD DIARRHEA

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Abstract

Diarrhea is a major public health problem causing morbidity and mortality in children under five years of age, particularly in developing countries like Indonesia. Low rates of exclusive breastfeeding and incomplete rotavirus immunization are important risk factors for diarrhea. This study aimed to examine the relationship between exclusive breastfeeding, rotavirus immunization status, and the incidence of diarrhea in children aged 6–24 months. The study used a case-control design with a quantitative approach, involving 80 respondents: 40 children with diarrhea and 40 children without diarrhea. Data were collected through structured questionnaires and medical record reviews and analyzed using the chi-square test. The results showed a significant association between exclusive breastfeeding and the incidence of diarrhea ($p < 0.05$), with children who were not exclusively breastfed having a 4.18-fold higher risk of diarrhea ($OR = 4.188$). Incomplete rotavirus immunization was also significantly associated with diarrhea, increasing the risk by 10.09 times compared to fully immunized children ($OR = 10.091$). Exclusive breastfeeding and complete rotavirus immunization are significant protective factors against diarrhea in children at the primary healthcare level.

Keywords: *Exclusive Breastfeeding ; Rotavirus Immunization ; Diarrhea ; Children ; Prevention*

1. Introduction

Diarrhea is a major public health problem worldwide, particularly in children under five years of age. Globally, diarrheal disease continues to be a leading cause of morbidity and mortality among children under five, particularly in developing countries. Rotavirus is recognized as a leading cause of severe acute gastroenteritis in children and a leading cause of diarrhea-related hospitalizations and deaths worldwide (Bilah et al., 2024).

In Indonesia, diarrhea is also a major public health problem in children under five years of age. Data from the 2017 Indonesian Demographic and Health Survey (PJS) showed that the incidence of diarrhea in infants aged 0–6 months in Indonesia was 9.1%, indicating that diarrheal disease remains a major cause of morbidity in children (Rusyda & Ronoatmodjo, 2021). Based on the Indonesian Basic Health Research, it was reported that the prevalence of diarrhea in children under five years old in Indonesia reached 3.5%, involving more than one million respondents (Oktaria et al., 2017).

Rotavirus is the most common cause of diarrhea in Indonesian children. A multicenter study in

Indonesia showed that approximately 50% of hospitalized diarrhea cases in children under five were caused by rotavirus infection, with the majority of cases occurring in children under two years of age (Mulyani et al., 2018).

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In Bali Province, diarrhea cases in children under five years of age remain common in healthcare facilities. Previous research conducted at Wangaya Regional General Hospital in Denpasar reported approximately 1,275 cases of diarrhea in children under five years of age. This indicates that diarrhea remains a common childhood health problem in Bali (Utami et al., 2023). Although the Indonesian government has expanded the rotavirus immunization program since 2023, evidence regarding the association between exclusive breastfeeding and rotavirus immunization status with diarrhea incidence in children aged 6-24 months at the primary health care level is still limited, especially in Indonesia and Bali.

Several previous studies have separately analyzed exclusive breastfeeding or immunization status in relation to diarrhea incidence. However, research analyzing both factors simultaneously in children aged 6-24 months is limited, particularly at the primary healthcare level. Therefore, this study aimed to analyze the association between exclusive breastfeeding and rotavirus immunization status with diarrhea incidence in children aged 6-24 months.

2. Method

This study was an analytic observational study with a case-control design conducted in the working area of Puskesmas I West Denpasar. A case-control study is an analytic observational design used to investigate associations between health outcomes and suspected risk factors by comparing subjects with a disease (cases) to those without (controls) and looking retrospectively for exposure differences (Lister et al., 2022).

The study subjects were children aged 6-24 months registered at the primary health care center, with the case group consisting of children who experienced diarrhea and the control group consisting of children without diarrhea. Each group comprised 40 children, resulting in a total sample of 80 children selected using consecutive sampling. Consecutive sampling involves including all eligible subjects who meet the study criteria in sequence until the desired sample size is reached, and it is frequently used in epidemiological field studies when probability sampling is not feasible (Ishak et al., 2023).

Data were collected through structured questionnaires completed by mothers or caregivers and through medical record reviews. The independent variables in this study were a history of exclusive breastfeeding and rotavirus immunization status, while the dependent variable was the occurrence of diarrhea. Data analysis was performed using the Chi-square test to assess associations between variables and Odds Ratios (ORs) with 95% confidence intervals were calculated to determine the magnitude of risk. Use of the Chi-square test and ORs is standard in case-control studies to evaluate the strength of associations between exposures and outcomes (Lister et al., 2022).

Ethical approval for this study was obtained from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Warmadewa (No: 196/Unwar/FKIK/EC-KEPK/XII/2025).

3. Result and Discussion

Table 1. General Characteristics of the Case and Control Groups

Characteristics	Case		Control	
	F (n)	(%)	F (n)	(%)
Sex of Childs				
Male	20	50,0	20	50,0
Female	20	50,0	20	50,0
Age of Childs				
0-11 months	14	35,0	30	75,0
12-23 months	19	47,5	8	20,0
≥ 24 months	7	17,5	2	5,0
Drinking Water Source				
Piped water	11	27,5	21	52,5
Well water	18	45,0	13	32,5
Handwashing practice				
Always	29	72,5	40	100,0
Sometimes	11	27,5	0	0,0
Maternal Education				
Junior high school	4	10,0	0	0,0

Characteristics	Case		Control	
Senior high school	31	77,5	23	57,5
Higher education	5	12,5	17	42,5
Maternal Occupation				
Housewife	26	65,0	34	85,0
Private sector employee	7	17,5	4	10,0
Trader	1	2,5	0	0,0
Self employed	4	10,0	2	5,0
Others	2	5,0	0	0,0
Total	40	100	40	100

Table 1 shows the general characteristics of the case and control groups. Based on the analysis of 80 respondents in the case and control groups, the distribution of sex in both groups was balanced, with 20 males (50.0%) and 20 females (50.0%) in each group. Most children in the case group were aged 12–23 months, totaling 19 children (47.5%), whereas in the control group, children aged 0–11 months were more predominant, accounting for 30 children (75.0%). The children's body weight was generally within the normal range. In the case group, six children had a body weight of 2,500 grams (15.0%) and 3,000 grams (15.0%), while in the control group, the most common body weight was 3,400 grams, observed in nine children (22.5%). Maternal education level was predominantly senior high school, with a higher frequency observed in the case group, comprising 31 mothers (77.5%), compared to 23 mothers (57.5%) in the control group. Regarding maternal occupation, housewives constituted the largest proportion in both groups. In the case group, 26 mothers (65.0%) were housewives, while in the control group, this number reached 34 mothers (85.0%). In terms of social and environmental factors, including drinking water sources and handwashing practices, most parents and children in the case group used well water as their primary drinking water source, accounting for 18 respondents (45.0%). In contrast, the majority of the control group used piped water (PDAM), comprising 21 children (52.5%). Overall, handwashing practices among mothers were generally good. Most mothers consistently washed their hands before feeding their children or engaging in other activities with them, as indicated by 29 respondents (72.5%) in the case group and all respondents (100%) in the control group.

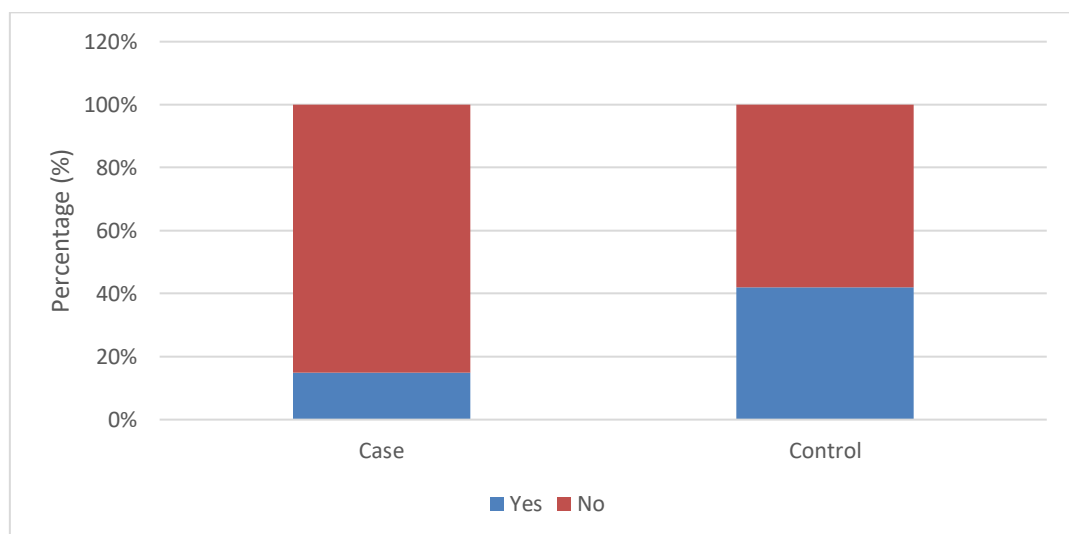


Figure 1. Comparison of exclusive breastfeeding of case and control groups

Figure 1 shows a comparison of exclusive breastfeeding history between the case and control groups. The proportion of children receiving exclusive breastfeeding was lower in the case group (15%) compared to the control group (42%). Conversely, non-exclusive breastfeeding was more common in the case group (85%) than in the control group (58%). This suggests that children in the case group were less likely to receive exclusive breastfeeding.

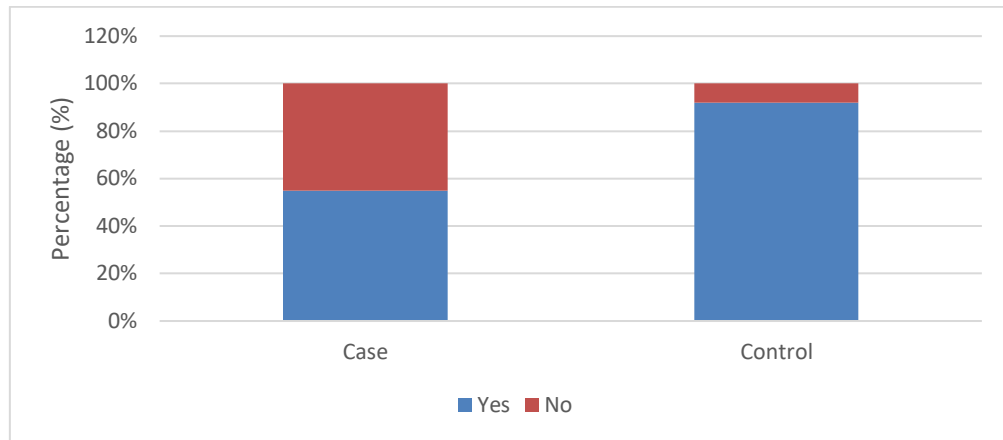


Figure 2. Comparizon of rotavirus immunization between case and control groups.

Figure 2 shows a comparison of rotavirus immunization status between the case and control groups. The proportion of children receiving rotavirus immunization was lower in the case group (55%) compared to the control group (92%). Conversely, incomplete immunization was more common in the case group (45%) than in the control group (8%). This suggests that lower immunization coverage may be associated with a higher incidence of diarrhea in the case group.

Table 2. Association between Exclusive Breastfeeding and Diarrhea Incidence in Case and Control Groups

Exclusive Breastfeeding	Case (n, %)	Control (n, %)	Total (n, %)	p-value	OR (95% CI)
Yes	6 (15.0%)	17 (42.5%)	23 (28.8%)	0.007	4.188 (1.436–12.218)
No	34 (85.0%)	23 (57.5%)	57 (71.2%)		
Total	40 (100%)	40 (100%)	80 (100%)		

Table 2 shows a significant association between exclusive breastfeeding and the incidence of diarrhea ($p=0.007$). Children who were not exclusively breastfed had a 4.19-fold higher risk of developing diarrhea compared to children who were exclusively breastfed (OR=4.188; 95% CI: 1.436-12.218).

Table 3. Association between Rotavirus Immunization Coverage and Diarrhea Incidence in Case and Control Groups

Rotavirus Immunization	Case (n, %)	Control (n, %)	Total (n, %)	p-value	OR (95% CI)
Yes	22 (55.0%)	37 (92.5%)	59 (73.8%)	0.000	10.091 (2.665–38.203)
No	18 (45.0%)	3 (7.5%)	21 (26.2%)		
Total	40 (100%)	40 (100%)	80 (100%)		

Table 3 shows a significant association between rotavirus immunization and diarrhea incidence ($p<0.001$). Children who did not receive rotavirus immunization had a 10.09-fold higher risk of developing diarrhea compared to those who had been immunized (OR=10.091; 95% CI: 2.665-38.203).

The results of this study align with current epidemiological evidence showing that non-exclusive breastfeeding is a significant risk factor for diarrhea in children. Previous research has shown that children who are not exclusively breastfed have a significantly higher risk of developing diarrhea, with an estimated more than threefold increase compared to children who are exclusively breastfed (Hossain & Mahrshahi, 2024). Other research conducted in Indonesia has shown that a lack of exclusive breastfeeding is strongly associated with an increased incidence of diarrhea in children under five years of age (Maxsi et al., 2025).

Exclusive breastfeeding supports the anatomical structure and function of the gastrointestinal tract by providing bioactive components such as secretory immunoglobulin A (sIgA), lactoferrin, breast milk oligosaccharides, and antimicrobial peptides. These components enhance mucosal barrier function, inhibit pathogen adhesion, and modulate the composition of the gut microbiota in a protective manner, thereby reducing susceptibility to enteric infections (Davis et al., 2022). A previous study showed that exclusively breastfed infants had significantly lower rates of acute gastroenteritis compared to infants who were partially or not breastfed (Branger et al., 2023).

Exclusive breastfeeding may also act as a protective factor against rotavirus infection, a leading cause of severe diarrhea in children. One study showed that breastfeeding significantly reduced the risk and severity of rotavirus-induced diarrhea, especially in infants under six months of age (Plenge-bönig et al., 2010). Another study showed that exclusive breastfeeding can reduce the severity of rotavirus infection by enhancing mucosal immunity and limiting viral replication (Uddin et al., 2025). Therefore, exclusive breastfeeding not only plays a role in reducing the incidence of diarrhea but also contributes to lowering the severity of the disease.

The results of this study also indicate a strong association between rotavirus immunization and a reduction in diarrheal disease incidence. This finding aligns with previous research showing that rotavirus vaccination significantly reduces the risk of severe diarrhea, with a substantial protective effect among vaccinated children (Prunas et al., 2025). Furthermore, other studies have reported that the introduction of rotavirus vaccination programs led to a 67% reduction in diarrhea-related hospitalizations in children under five years of age (Burnett et al., 2018).

The mechanism of rotavirus infection causes damage to intestinal epithelial cells, particularly mature enterocytes in the small intestine. This leads to villous atrophy, malabsorption, and increased intestinal permeability. Rotavirus vaccination induces humoral and cellular immune responses that limit viral replication and maintain intestinal epithelial integrity, thereby reducing the severity and duration of diarrheal episodes (Hu et al., 2024; Laban et al., 2022).

A study reported that factors related to sanitation and environmental hygiene significantly influence the incidence of diarrhea in children under five years of age. This emphasizes the importance of cleanliness and water quality in the occurrence of gastrointestinal infections (Himawatia & Fitria, 2020). Other research shows that inadequate access to clean water and microbiological contamination are strongly associated with increased incidence of diarrhea in children living in small island communities (Himawatia & Fitria, 2020). Furthermore, maternal behavior, sanitation practices, and family support were found to significantly influence the incidence of diarrhea in toddlers. This indicates that diarrhea is multifactorial and influenced by behavioral and environmental determinants (Dewanti et al., 2025).

Overall, the results of this study suggest that exclusive breastfeeding and rotavirus immunization should not be viewed as isolated protective factors, but rather as part of an integrated prevention strategy. Physiologically, exclusive breastfeeding can enhance innate mucosal immunity and promote beneficial gut microbiota, while vaccination can provide specific adaptive immunity against pathogens. This, combined with improved hygiene, sanitation, and maternal practices, can protect the digestive system and significantly reduce the incidence and severity of diarrhea in children.

4. Conclusion and Suggestion

The results of this study conclude that exclusive breastfeeding and rotavirus immunization are significantly associated with a reduced incidence of diarrhea among children aged 6-24 months. Children who did not receive exclusive breastfeeding were found to have a higher risk of developing diarrhea, while those who did not receive rotavirus immunization according to the recommended schedule exhibited an even greater risk. These findings highlight the importance of early-life nutritional and immunological interventions in the prevention of childhood diarrhea. From an anatomical and functional perspective, exclusive breastfeeding supports gastrointestinal tract integrity by enhancing mucosal barrier function, promoting beneficial gut microbiota, and strengthening innate immune defenses. In contrast, rotavirus immunization provides pathogen-specific adaptive immunity, thereby protecting the intestinal epithelial architecture from virus-induced injury. The combined effects of these two interventions contribute to a more robust gastrointestinal barrier, reducing susceptibility to infection and the severity of diarrheal disease in children.

Based on the findings of this study, it is recommended to strengthen health promotion efforts regarding the importance of exclusive breastfeeding during the first six months of life and to expand

rotavirus immunization coverage, particularly at the primary healthcare level. Health promotion activities directed at parents or caregivers should emphasize the preventive role of these interventions against diarrhea and their impact on gastrointestinal tract development. Further research is recommended to explore the long-term effects of exclusive breastfeeding and rotavirus immunization on the development and function of the gastrointestinal system, as well as to include broader populations and additional biological indicators to better elucidate the underlying protective mechanisms.

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