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Correlation between Nutritional Status and Diarrhea in Toddlers at Slawi Health Center, Tegal, Central Java, Indonesia

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ABSTRACT

Background: Diarrhea is a symptom of infection caused by bacteria, viruses, or parasites. It remains a significant public health issue in Indonesia that requires continued research and effective solutions. This study aimed to determine the relationship between nutritional status and the incidence of diarrhea among toddlers at the Slawi Public Health Center, Tegal Regency.
Subjects and Method: A cross-sectional study was conducted in the working area of the Slawi Public Health Center from June to July 2023. A total of 190 subjects were selected for the study. The dependent variable was the incidence of diarrhea, while the independent variable was nutritional status. Nutritional status data were collected using height-for-weight measurements. Data were analyzed using the chi-square test.
Results: Nutritional status was found to be associated with the incidence of diarrhea among toddlers. Toddlers with abnormal nutritional status had a 1.73 times higher risk of experiencing diarrhea compared to those with normal nutritional status, and this result was statistically significant (OR = 1.73; 95% CI = 1.13–2.66; p = 0.005).
Conclusion: Abnormal nutritional status is associated with a higher incidence of diarrhea among toddlers.

Keywords: diarrhea, nutritional status, toddlers

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BACKGROUND

Diarrhea is a symptom of infection caused by bacteria, viruses, or parasites. It is also defined as the passage of loose or watery stools with a frequency of more than three times in 24 hours. If it lasts ≤2 weeks, it is classified as acute diarrhea; if ≥2 weeks, it is classified as chronic diarrhea (WHO, 2017). Nutritional status is the condition of the body as a result of the consumption of food and other nutrients, which can be categorized into severe malnutrition, undernutrition, normal nutrition, and overnutrition. Nutritional status can be influenced by food intake and the presence of health or infections (Mardalena dan

Suryani, 2016).

According to WHO, globally, there are approximately 1.7 billion cases of diarrhea in children each year. Diarrhea is the second leading cause of death among children under the age of 5, resulting in approximately 525,000 deaths annually (WHO, 2017). In 2019, 370,000 child deaths were attributed to diarrhea. (Rahmawati, 2019). In Indonesia, diarrhea remains a persistent health issue. In 2017, there were 21 recorded outbreaks of diarrhea (KLB), spreading across 12 provinces and 17 districts/cities, with 1,725 cases and 34 deaths. (Amin, 2015). Based on the 2018 Basic Health Research (RISKESDAS) data, Tegal Regency ranked third in Central Java for diarrhea prevalence, with a rate of 18.3%. Data from the Tegal District Health Office showed that Slawi Subdistrict ranked third within Tegal Regency for diarrhea cases, with a total of 1,511 cases (Riskesdas, 2019).

A study by Ma'arif et al. (2021) found a significant relationship between diarrhea and nutritional status in toddlers. Toddlers with good nutritional status were more likely not to experience diarrhea, while those with poor nutritional status were more likely to have diarrhea. Nutritional status is a risk factor for acute diarrhea in toddlers due to their susceptibility to infections. Nutritional status in toddlers must be closely monitored, as undernutrition can have severe consequences. These include increased vulnerability to infections and diseases, low birth weight (LBW), a higher risk of mortality, chronic diseases in adulthood, and delays in mental development (Alim et al., 2021).

Based on this background, it is necessary to address the spread of diarrhea cases. Therefore, this study aims to provide insights and determine whether there is a relationship between nutritional status and the incidence of diarrhea among toddlers at the Slawi Public Health Center, Tegal Regency.

SUBJECTS AND METHOD

1. Study Design

This study used an analytical observational method with a cross-sectional approach. The research was conducted from June to July 2023 in the working area of the Slawi Public Health Center, Tegal Regency.

2. Population and Sample

The target population in this study was all toddlers in Tegal Regency, while the accessible population was toddlers aged 12–60 months residing in the working area of the Slawi Public Health Center. Respondents who met the inclusion and exclusion criteria were selected as study participants using consecutive sampling, resulting in a total sample size of 190, determined using the cross-sectional sample size formula.

3. Study Variables

The dependent variable was the incidence of diarrhea. The independent variable was nutritional status.

4. Operational Definition of Variables

Diarrhea incidence refers to whether a toddler had diarrhea, assessed via a questionnaire and categorized as "no diarrhea" or "diarrhea." This is measured on an ordinal scale.

Nutritional status is assessed based on weight-for-height (W/H) or weight-for-age (W/A) and categorized as overnutrition, normal nutrition, undernutrition, and severe malnutrition, based on the results of physical measurements. This is also measured on an ordinal scale.

5. Study Instruments

To assess nutritional status, body weight and height measurements were taken. To assess diarrhea incidence, a questionnaire

was used containing several questions about the respondent's personal data and health status.

6. Data analysis

This study used both univariate and bivariate analysis. The univariate analysis aimed to describe in detail the characteristics of each variable, producing frequency distributions. The bivariate analysis was conducted to examine the relationship between variables using the chi-square test.

7. Research Ethics

This study received ethical approval (Ethical Clearance) from the Ethics Committee of the Faculty of Medicine, Universitas Swadaya Gunung Jati (No. 107/EC/FKUGJ/VI/2023). The researchers also obtained permission from the Tegal District Health Office and the Head of the Slawi Public Health Center to collect data. During the research process, participants were informed about the study to ensure understanding and willingness to participate. The researchers also assured respondents of the confidentiality of the data collected and sought informed consent before including them as study subjects.

RESULTS

1. Sample Characteristics

The description of the sample characteristics is presented to provide an overview of the respondents' profiles in this study. This includes key demographic and socio-economic variables such as the age of mothers and toddlers, occupation, educational level, and household income.

Table 1. Respondent Characteristics

Characteristics	Frequency (n)	Percentage (%)
Mother's Age		
20- 30 years	132	69.5
>30 years	58	30.5
Toddler's Age (months)		
12	33	17.4
13-24	59	31.1
24-60	98	51.6
Occupation		
Nurse	1	0.5
Housewife	161	84.7
Village apparatus	2	1.1
Teacher	4	2.1
Trader	7	3.7
Private employee	7	3.7
Education		
Bachelor degree	20	10.5
High school	95	50.0
Junior high school	46	24.2
Elementary school	23	12.1
No formal education	6	3.2
Monthly Income		
Above minimum wage	38	20.0
Equal to minimum wage	67	35.3
Below minimum wage	85	44.7

Table 1 presents the characteristics of the respondents in this study, consisting of mothers and their toddlers. The majority of the mothers were aged between 20 and 30 years, accounting for 132 individuals (69.5%). In terms of the toddlers' age, most were between 24 and 60 months (51.6%). Regarding occupation, most mothers were housewives (84.7%). In terms of educational background, half of the respondents had completed high school (50.0%). In terms of monthly income, the majority of respondents came from families earning below the minimum wage (44.7%).

2. Univariate analysis

The univariate analysis was conducted to provide a comprehensive overview of the characteristics of each variable studied. This type of analysis involved summarizing the data using frequency distributions, which allowed for a clear depiction of how individual variables, such as nutritional status and incidence of diarrhea, were distributed across the sample.

Table 2. Distribution of Nutritional Status and Diarrhea Incidence

Variable	Frequency (n)	Percentage (%)
Nutritional Status		
Severely wasted	9	4.7
Wasted	19	10.0
Normal	147	77.4
Overweight	15	7.9
Diarrhea Incidence		
Diarrhea	86	45.3
No diarrhea	104	54.7
Total	**190**	**100**

Table 2 presents the distribution of respondents based on nutritional status and diarrhea incidence among toddlers. Most of the toddlers had a normal nutritional status, totaling 147 individuals (77.4%). A smaller proportion were categorized as wasted (10.0%) and severely wasted (4.7%), indicating undernutrition. Additionally, some toddlers were classified as overweight (7.9%).

In terms of diarrhea incidence, 86 toddlers (45.3%) experienced diarrhea, while 104 toddlers (54.7%) did not. The total number of respondents in this dataset was 190 toddlers (100%). These findings provide an overview of the nutritional and health status of the study population, highlighting both undernutrition and overnutrition issues, as well as the prevalence of diarrheal disease.

3. Bivariate analysis

Bivariate analysis was performed to assess the association between nutritional status and the incidence of diarrhea, utilizing the Chi-square test to determine statistical significance. Table 3 illustrates the relationship between nutritional status and the incidence of diarrhea among toddlers. Among those with normal nutritional status, 89 toddlers (60.5%) did not experience diarrhea, while 58 toddlers (39.5%) did. In contrast, among toddlers with abnormal nutritional status (including categories such as severely wasted, wasted, and overweight), a larger proportion of 28 toddlers (65.1%) experienced diarrhea, compared to 15 toddlers (34.9%) who did not.

Statistical analysis revealed a significant association between nutritional status and diarrhea incidence, with an odds ratio (OR) of 1.73, indicating that toddlers with

abnormal nutritional status were 1.73 times more likely to suffer from diarrhea compared to those with normal nutritional status (OR = 1.73; 95% CI = 1.13–2.66; p= 0.005;).

Table 3. Relationship between Nutritional Status and Diarrhea Incidence

Variable	Diarrhea				OR	95% CI		p
	No		Yes			Lower Limit	Upper Limit	
	N	%	N	%				
Nutritional Status								
Normal	89	60.5	58	39.5	1.73	1.13	2.66	0.005
Abnormal	15	34.9	28	65.1				

DISCUSSION

This study found that among 147 toddlers with good nutritional status, 58 (30.5%) experienced diarrhea, while 89 (46.8%) did not. Statistical analysis using the chi-square test revealed a significant relationship between nutritional status and the incidence of diarrhea, indicating that toddlers with good nutritional status were less likely to suffer from diarrhea.

These findings are consistent with previous research by Ma'arif et al. (2021) and Alim et al. (2021), which also reported a significant association between nutritional status and diarrhea among toddlers. Toddlers with poor nutritional status are more vulnerable to infections due to impaired immune function. Adequate nutrition plays a critical role in strengthening the immune system and maintaining the integrity of the gut mucosal barrier—both of which serve as key defenses against enteric pathogens. For example, Sasmito *et al.* (2023) found that toddlers with poor nutritional status were significantly more susceptible to diarrhea, highlighting an eightfold increase in risk when exclusive breastfeeding was not maintained. This underscores the importance of balanced nutritional intake, which can be achieved through appropriate complementary feeding and continued breastfeeding to help reduce the risk of diarrheal infections.

Similarly, Putri et al. (2024) reported that toddlers with good nutritional status experienced fewer episodes of diarrhea compared to their malnourished counterparts. Their study emphasized the multifactorial nature of diarrhea prevention, suggesting that knowledge of nutritional needs, socioeconomic conditions, and proper immunization collectively contribute to a reduced incidence. Supriadi et al. (2020) also emphasized that optimal nutritional intake supports overall growth and enhances gut integrity, both of which help prevent gastrointestinal infections. In line with this, Astiti et al. (2022) explained that improved nutritional status combined with better environmental sanitation can significantly reduce the likelihood of diarrhea among young children. This connection may be attributed to improved micronutrient status, which strengthens both innate and adaptive immune responses, thereby lowering susceptibility to diarrhea-causing pathogens.

Yulvia et al. (2024) also noted that maintaining good nutritional status during early childhood is essential not only for achieving developmental milestones but also as a protective factor against infectious diseases such as diarrhea. Similarly, Linda

and Daryanti (2022) supported these findings by demonstrating an inverse relationship between robust nutritional status and diarrheal prevalence. They highlighted how adequate intake of both macronutrients and micronutrients supports immune function and maintains a balanced gut microbiota, ultimately reducing the risk of gastrointestinal disturbances.

Collectively, these findings suggest that interventions aimed at improving nutritional status, such as education on exclusive breastfeeding, dietary diversity, and overall nutritional adequacy, may serve as effective strategies in reducing diarrhea incidence among toddlers. This body of evidence reinforces the vital role of nutrition in pediatric health, particularly in shaping infection control and prevention strategies for vulnerable populations.

Moreover, nutritional status is influenced by both direct and indirect factors. Direct factors include food intake and infection, while indirect factors involve parental knowledge, education level, income, and occupation. Better parental education and higher income levels are associated with improved child health outcomes (Rasyid et al., 2021). One of the primary contributing factors is the history of infectious diseases. Toddlers who experience frequent illnesses are at higher risk of poor nutritional status, as repeated infections can impair nutrient absorption and hinder growth. For example, Nur and Suryana (2021) observed that a history of repeated illnesses in the preceding three months was significantly associated with stunting, suggesting that the frequency and duration of illness negatively affect nutritional outcomes. Recurrent infections may further reduce nutrient utilization and suppress appetite, exacerbating nutritional deficiencies.

Parental factors, especially maternal education and knowledge, consistently emerge as key determinants. Studies show that higher maternal education and better nutritional knowledge enable caregivers to make informed decisions regarding complementary feeding, exclusive breastfeeding, and hygienic food preparation. Research by Kii et al. (2024) and Suryana et al. (2022) affirmed that mothers with better education are more likely to ensure a nutrient-rich diet for toddlers, reducing the risk of malnutrition. Likewise, Ansuya et al. (2018) confirmed that parental education and socioeconomic status are closely linked to improved child nutrition, as they enable caregivers to access and apply nutritional guidelines more effectively.

Socioeconomic conditions also play a critical role in shaping toddler nutrition. Nurprastiwi et al. (2024) and Aiman et al. (2024) emphasized that financial limitations can restrict access to diverse and nutritious food options. Household income directly affects the quantity and quality of available food, which is essential for maintaining adequate nutrition. Saputro et al. (2023) additionally pointed out that cultural norms and family eating habits influence dietary intake; families that regularly consume a diverse diet tend to show lower rates of malnutrition. Feeding practices particularly breastfeeding and complementary feeding are also vital components. Karina (2023) highlighted that early initiation and sustained exclusive breastfeeding, followed by the timely introduction of nutrient-rich complementary foods, are essential for supporting optimal growth and immune function in toddlers. Junita et al. (2023) further demonstrated that nutrition education especially when delivered through modern technology can enhance caregivers' ability to choose appropriate foods, ultimately improving toddler nutritional status.

Environmental factors, such as sanitation and health monitoring, also contribute. Lestari et al. (2023) discussed the use of Maternal and Child Health (MCH) books, which help track a toddler's growth and nutrition status, enabling timely detection and intervention in cases of nutritional deficiencies. Soboksa et al., (2020) also found that access to clean water and proper sanitation directly impacts nutritional health by reducing gastro-intestinal infections that can lead to nutrient loss.

This study also found that toddlers with overnutrition, such as overweight or obesity, were not immune to diarrhea. Overweight toddlers are not immune to diarrhea because excess weight does not equate to optimal nutrient balance or enhanced immune function. Although an overweight status may indicate high caloric intake, it often stems from diets that are energy-dense yet deficient in essential micronutrients that are crucial for proper immune system functioning. For instance, high intake of processed foods or sugars combined with low consumption of dietary fiber and micronutrient-rich fruits and vegetables can lead to imbalances in gut microbiota, which, in turn, may compromise the intestinal barrier and predispose individuals to infections, including diarrhea (Li et al. 2021).

Moreover, adipose tissue in overweight individuals is known to produce inflammatory cytokines and hormones that can disrupt intestinal homeostasis. Linsalata et al. (2023) emphasize that the altered hormonal and neurotransmitter profiles in overweight patients can affect gut motility and immune responses, thereby impairing the intestine's barrier function. This impaired barrier may allow for easier translocation of pathogens, which increases the risk of diarrheal diseases despite the seemingly "adequate" energy reserves associated with overweight status.

Additionally, overweight status can coexist with micronutrient deficiencies, a paradox often observed in cases where nutrient quality is compromised. This condition, sometimes described as "hidden hunger," suggests that although energy intake is high, the lack of sufficient vitamins and minerals can undermine immune function and gut integrity. Hence, overweight toddlers might experience chronic low-grade inflammation, making them more susceptible to infections that can trigger diarrhea (Linsalata et al., 2023).

AUTHOR CONTRIBUTION

Alfinatun Musdzalifah, Uswatun Khasanah, and Niklah Zaidah collaborated in determining the research title, selecting the sample, developing the conceptual framework and research methodology, and analyzing the data.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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