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Correlation between Severity of Diarrhea and Blood Sodium Levels in Adult Patients with Acute Gastroenteritis at Manado Adventist Hospital North Sulawesi

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Abstract

Introduction: *Acute gastroenteritis has become a leading cause of global mortality, with approximately 41 million deaths each year, about 85% of which occur in low- and middle-income countries. Acute gastroenteritis is often associated with the severity of diarrhea, which serves as a primary indicator in its management, particularly concerning blood sodium levels.* ***Objective:*** *The aim of this study is to determine the relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis at Advent Hospital Manado, North Sulawesi.* ***Methods:*** *This study employs an analytical observational design with a retrospective cross-sectional approach. Secondary data were obtained from patient medical records. A total sampling method was used, resulting in 249 samples that met the inclusion and exclusion criteria, along with vesikari scoring.* ***Results and Discussion:*** *Based on the study results, 196 (78,7%) patients had normal sodium levels, with the majority experiencing moderate diarrhea severity, accounting for 126 (50,6%) patients. The results of the Chi-square test analysis show that p-value=0,320.* ***Conclusion:*** *There is no correlation between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis at Advent Hospital Manado.*

Keywords: Blood Sodium Levels; Diarrhea; Vesikari Scoring;

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Introduction

Diarrhea occurs when a person has a bowel movement with stools that are soft to liquid, with a frequency of three or more times a day. Clinically, the causes of diarrhea are divided into six main groups, namely bacterial infections, viral or parasitic infections, absorption disorders, allergies, poisoning, and immunodeficiency or lack of immunity (Adhiningsih & Juniastuti, 2019)

Acute gastroenteritis has become the leading cause of death globally, with about 41 million deaths each year, of which 85% of the figure occurs in low- and middle-income countries (Siswati, Kasjono, & Olfah, 2022). In 2019, there were 2,455,098 cases of gastroenteritis across the country that continue to be faced and need control against the disease, especially given the high prevalence among children and adult populations (Khoirunnisa, 2020)

The World Health Organization (WHO) reports that every year, about 1.87 million people die from gastroenteritis, with most deaths occurring in children under the age of five. The incidence of gastroenteritis in Asia reached 411 per 1,000 population in 2017 (SAGITARISANDI, 2021)

The Indonesian Health Profile states that in 2018, the diarrhea death rate in Indonesia reached 4.76%. The highest prevalence of diarrhea occurs in children. According to Basic Health Research (Riskesdas) in 2018, the prevalence of diarrhea in Indonesia based on the diagnosis of health workers is 6.8% (Nari, 2019)

Basic Health Research (Riskesdas) states that diarrhea is one of the health problems that are often faced by people in the city of Manado. North Sulawesi ranked third lowest with 22.2% coverage for diarrheal diseases in 2019 (Pricilia, Sondakh, & Akili, 2021). In 2022, North Sulawesi was recorded to have a total of 2086 cases of diarrhea (DISKOMINFO Province Sulawesi Utara. Satu Data. 2023)

Acute gastroenteritis is often associated with diarrhea, where the severity of diarrhea is a major indicator in its management, especially related to blood sodium levels. The study of Afolabi et al (2019) found that children with acute diarrhea caused by various types of viruses tend to experience decreased blood sodium levels, which can lead to hyponatremia. The study also showed that zinc deficiency contributed to higher severity, dehydration, and longer duration of treatment (Afolabi, Saka, Ojuawo, & Biliaminu, 2019)

The relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis is important to understand given the high incidence of diarrhea in Indonesia. A retrospective cross-sectional study by Salwan *et al* in 2008 on the description of plasma sodium and potassium levels based on nutritional status before and after rehydration in diarrhea cases treated at the IKA RSCM Department revealed that in patients who are severely dehydrated due to diarrhea, serum sodium levels can decrease drastically, requiring prompt and appropriate treatment to prevent serious symptoms such as seizures or even coma. This suggests that monitoring blood sodium levels should be an integral part of the management of patients with acute gastroenteritis (Salwan et al., 2016)

Research conducted by Ramdany in 2022 related to the description of serum electrolyte levels (Na+, K+, Cl-) in pediatric diarrhea patients aged 1 to 5 years at Depok Hospital, showed that sodium loss in feces can reach 50–98 mEq/l in patients with a diagnosis of acute diarrhea, and this loss has a contribution to the development of hyponatremia. Proper treatment including rehydration with electrolyte-containing fluids is essential to restore sodium balance in the body (Ramdany, 2022)

Research on the relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis in North Sulawesi is still very limited. Based on a review of previous research at Pasar Rebo Hospital, East Jakarta, the number of gastroenteritis cases continues to increase until early 2024. This prompted researchers to examine the relationship in adult patients with acute gastroenteritis during the period January to December 2023 (Izzatul, 2024)

Advent Hospital Manado was chosen as the location of the study because the survey showed that this hospital received many patients with gastroenteritis and was one of the BPJS referral hospitals that was widely used by the community. This research is expected to encourage the improvement of services for acute gastroenteritis patients at Advent Hospital Manado.

Methods

This type of research is quantitative using an analytical observational design and a cross-sectional approach. The research is retrospective by using secondary data in the form of medical record data. This design was chosen to evaluate the relationship between the severity of diarrhea and serum sodium levels in adult patients with acute gastroenteritis by using vesicy scoring to assess the severity of diarrhea.

Results and Discussion

The total patient population was 625 patients and the number of samples that met the inclusion and exclusion criteria was 249 samples. This study uses statistical analysis assisted by data processing on IBM SPSS Statistics.

Table 1

Distribution of Sample Characteristics by Age and Gender

Sample Characteristics		**n**	**%**
Age	18 – 40 Years	90	36,1
	41 – 60 years old	99	39,8
	>60 Years	60	24,1
Total		**249**	**100**
Gender	Man	85	34,1
	Woman	164	65,9
Total		**249**	**100**

Table 1 was obtained through the results of data processing that showed the characteristics of the sample selected in this study. The characteristics in this study are seen from age and gender.

Table 2
Sample Distribution Based on Blood Sodium Classification

Sodium Classification	n	%
Hyponatremia	53	21,3
Normonatremia	196	78,7
Hypernatremia	0	0
Total	**249**	**100**

The data in table 2 shows the distribution of samples based on the classification of blood sodium levels, which was obtained based on the measurement of patient laboratory results, with a sample number of 249 patients. Based on the table, it was shown that diarrhea patients with acute gastroenteritis who had a normonatremia level classification were 196 patients (78.7%).

Table 3
Sample Distribution According to Diarrhea Severity

Severity of Diarrhea	n	%
Mild	9	3,6
Moderate	126	50,6
Severe	114	45,8
Total	249	100

Table 3 shows the distribution of samples according to the severity of diarrhea, which uses the diarrhea criterion according to vesicy scoring. The number of samples in this study was 249 patients where there were diarrhea patients with acute gastroenteritis who suffered more from diarrhea with moderate severity as many as 126 patients (50.6%).

Table 4
Analysis of the Relationship between Sodium Levels and Diarrhea Severity

	Na+ Levels			Total	ρ-Value
	Hypo-Natremia	Normo-Natremia	Hyper-natremia		
Severity					
Mild	2 (0,8%)	7 (2,8%)	0	3,6%	0,320
Moderate	22 (8,8%)	104 (41,8%)	0	50,6%	
Severe	29 (11,6%)	85 (34,1%)	0	45,8%	
Total	**53 (21,3%)**	**196 (78,7%)**	**0**	**100%**	

Based on the results of the *Chi-Square* statistical test obtained, *the Chi-Square* value shows a ρ-value of 0.320. This value is more than the specified significance level (ρ<0.05). Thus, the results of this analysis showed that there was no significant relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis at Advent Hospital Manado, North Sulawesi. These results indicate that differences in the severity of diarrhea (mild, moderate, and severe) do not significantly affect patients' blood sodium levels.

Research conducted at Manado Adventist Hospital shows the characteristics of acute diarrhea patients based on age and gender. Through 249 samples that met the inclusion criteria, the results showed that the age group of 41-60 years was the most

diagnosed group, with a percentage of 39.8% (99 patients) of the total sample. In addition, the analysis by gender revealed that female patients dominated with a total of 164 patients (65.9%), compared to 85 male patients (34.1%).

According to Hurlock, adulthood is divided into 3 periods, namely early adulthood, middle adulthood, and late adulthood. The early adult period begins at the age of 18 – 40 years, the middle adult period begins at the age of 40 – 60 years, and the late adult period begins at the age of 60 years until death. This research underlies Hurlock's theory of intermediate adulthood which took samples with the age of 41 – 60 years. A study by Saputra Dwilianto (Dwilianto, Matondang, & Yarni, 2024) in 2021 on the characteristics of acute gastroenteritis in patients at Sanglah Hospital Denpasar In 2018, it was noted that individuals between the ages of 41 to 60 years have a higher risk of gastrointestinal infections due to a decline in the immune system as they age.

In addition, the aging process that reduces epithelial regeneration and the body's ability to fight infections also plays an important role in increasing susceptibility to gastrointestinal infections. Saputra *et al* found that the adult age group recorded the highest number of cases of acute gastroenteritis, which suggests that individuals in the age range of 41 – 60 years are more susceptible to bacterial infections. Age is an important factor, where older individuals often have less efficient physiological mechanisms in coping with dehydration compared to younger individuals (Saputra, Mariadi, & Somayana, 2021)

The prevalence of diarrhea in women has been noted in studies, which suggests that hormonal and behavioral health factors can influence a woman's tendency to experience this condition. Research by Amyati (Indang, Towidjojo, & Bachtiar, 2023) in 2023 on the analysis of factors related to the incidence of diarrhea in State Junior High Schools in Yogyakarta, found that women have a higher incidence of diarrhea compared to men with a percentage of 54.44% of the total diarrhea cases in the city of Yogyakarta (Pratiwi, 2023)

Moderate severity of diarrhea in patients with acute gastroenteritis can contribute to the risk of dehydration and electrolyte imbalances, especially sodium levels in the blood. Gastroenteritis, which is often caused by a viral or bacterial infection, can cause significant fluid loss through more liquid stools. Research shows that patients with moderate diarrhea experience a decrease in blood sodium levels, which can lead to hyponatremia if not treated properly. According to research by Salwan (Irawan et al., 2024), patients who were severely dehydrated due to diarrhea showed a drastic decrease in serum sodium levels, requiring rapid intervention to prevent serious complications such as seizures or coma. The mechanism of fluid and electrolyte loss occurs through osmotic disturbances and imbalanced ion secretion in the intestines, which worsens the patient's condition (Ibrahim & Sartika, 2021)

In the context of this study conducted at Manado Adventist Hospital, the results of the analysis of 249 adult patients showed that 78.7% of patients had sodium levels in the normal range despite experiencing symptoms of gastroenteritis. This suggests that not all patients with acute diarrhea will experience significant changes in their blood sodium

levels. These findings are in line with the results obtained by Ramdany who stated that although dehydration can cause electrolyte changes, the body's response to fluid loss varies depending on many factors namely age, health status, and environmental conditions. Health status also plays a role in individuals with medical conditions such as diabetes or kidney disease, who may have difficulty maintaining fluid and electrolyte balance. Environmental conditions such as temperature and humidity can affect the rate of fluid loss, such as in hot weather, the body will lose fluid faster through sweat. This can increase the risk of diarrhea if fluid intake is insufficient (Ramdany, 2022), (Wololi & Manoppo, 2016)

This study aims to analyze the relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis at Advent Hospital Manado. Based on the results of the study, no significant relationship was found between the severity of diarrhea (mild, moderate, and severe) and the most common blood sodium level was normonatremia in adult patients with acute gastroenteritis (p-value = 0.320). These findings indicate that even if patients experience symptoms of acute gastroenteritis, their blood sodium status remains stable in most cases. This emphasizes the importance of individual monitoring of the patient's condition as well as taking into account other factors such as previous medical history and hydration status prior to the onset of diarrhea (Wololi & Manoppo, 2016)

This study provides an overview of the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis. Most patients had moderate severity (50.6%) diarrhea, followed by severe (45.8%) and mild (3.6%) diarrhea, which reflected a common distribution in the adult population and could generally be treated with oral or intravenous rehydration without serious complications. As many as 78.7% of patients had normal sodium levels (normonatremia), while 21.3% had hyponatremia, and no cases of hypernatremia were found. These results show that there is a compensation mechanism for the body in maintaining sodium balance, especially in patients who receive proper rehydration, although in patients with severe diarrhea, the risk of hyponatremia still needs to be anticipated. Factors such as age, early hydration status, and the presence of comorbidities can affect blood sodium levels, with patients who are severely dehydrated before treatment or have kidney disease more susceptible to hyponatremia. Therefore, regular monitoring of sodium levels and prompt treatment of electrolyte disturbances are important to prevent serious complications, such as seizures or coma, while further research with prospective designs is needed to deepen understanding of this relationship (Kemenkes, 2023)

The patient's initial hydration status before the onset of diarrhea is very important. Patients who were already dehydrated before suffering from diarrhea may be more susceptible to hyponatremia than those who are well hydrated. Dehydration causes a decrease in blood volume, which stimulates the secretion of antidiuretic hormone (ADH) to retain body fluids. However, this increase in ADH can also lead to excessive water retention, thereby diluting sodium levels in the blood. Comorbidities such as kidney disease or the use of certain medications can also affect sodium metabolism and the body's

response to fluid loss. The use of certain medications, such as diuretics, can contribute to sodium loss. This drug will increase the excretion of sodium through the urine, thereby worsening the condition of hyponatremia in patients who are already experiencing fluid loss due to diarrhea (Ramdany, 2022), (Kemenkes, 2023)

The results of this study have important clinical implications for the practice of managing patients with acute gastroenteritis. Regular monitoring of blood sodium levels should be done to identify patients at high risk of hyponatremia. This study has several significant advantages, especially in the context of understanding the relationship between the severity of diarrhea and blood sodium levels in adult patients with acute gastroenteritis. The study's focus on the 41-60 year age group provides deeper insights into the characteristics of patients in this age range, which have often been underrepresented in previous studies. By analyzing data from Manado Adventist Hospital, this study produced relevant and up-to-date information about the prevalence of gastroenteritis in the region, as well as its impact on public health. In addition, the study also considered various factors that affect blood sodium levels, such as gender and length of stay, allowing for the identification of patterns that can be used to improve the clinical management of patients.

This study also has limitations that need to be considered, such as a retrospective research design using secondary data from medical records, so there are limitations in ensuring the validity and completeness of the data used. This study was only conducted at Manado Adventist Hospital, so the results may not be generalized to the wider population. In addition, outcome variables such as the patient's history of early hydration, comorbidities, or the use of certain medications that may affect the results of the study are not fully controllable. The *sampling* method used is *total sampling*, but the results still depend on the availability of patient data that meets the inclusion and exclusion criteria. Assessment of diarrhea severity also relies on the vesicles scoring system, which is subjective and potentially biased.

Conclusion

Distribution of blood sodium levels Most patients have normonatremia and none of the patients have hypernatremia. The distribution of diarrhea severity with the highest number is at a moderate level. There was no significant association between the severity of diarrhoea and blood sodium levels in adult patients with acute gastroenteritis (p-value = 0.320)

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