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Risk Factors of Catheter-Associated Urinary Tract Infections in Hospitalized Patients in Internal Medicine Ward of Tertiary Referral Hospital in Indonesia

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ABSTRACT

Introduction: Urinary Tract Infection (UTI) is the most common type of nosocomial infection. An increase of 80% of nosocomial urinary tract infections is caused by the usage of urinary catheters. Previous studies have found that inpatients are more susceptible to UTI than outpatients.
Objective: The Objective of this study is to assess the prevalence and risk factors for internal medicine patients at tertiary referral hospitals in Surabaya with Catheter Associated Urinary Tract Infections (CAUTI). These findings may aid in strategies to minimize CAUTI occurrences.
Methods: This study was a single-center cross-sectional study that obtained data from medical records. Data samples were tested using Chi-Square to find a correlation between UTI and age, gender, length of stay, and underlying disease or comorbidities with a p-value of p<0,05.
Results: The proportion of patients who experienced CAUTI during May 2020-May 2021 was 32.8%. The characteristics of the sample in this study were in the age range of 28 to 78 years with an average of 54 years. There were four male patients and 17 female patients in the CAUTI group. The p-values for age, gender, duration of hospitalization, and underlying disease or comorbidities were 0.465 (p>0.05); 0.064 (p>0.05); 0.146 (p>0.05); and 0.064 (p>0.05).
Conclusions: There was a reduction in the prevalence of CAUTI from 2018 compared to 2020-2021. There were no variables that were significantly associated as risk factors for CAUTI.

Introduction

Urinary tract infections (UTIs) are the most common type among all healthcare or community-related infections. While Catheter-Associated Urinary tract infections account for approximately 26.7% of all device-associated infections. A Catheter-Associated Urinary tract infection occurs when a bacteria invades the body through a catheter into the urinary tract and the bladder (Mangal et al., 2021). Although it rarely causes symptoms, CAUTIs are known to be associated with increased mortality and length of stay in acute care

facilities. Besides that, UTI can also lead to urosepsis which accounts for a quarter of sepsis cases (Utami et al., 2022). With the presence of CAUTI complications, the cost of multiple blood cultures, additional days of parenteral antibiotics, and longer hospital stays may be affected (Hollenbeak & Schilling, 2018). Previous studies reported that risk factors for CAUTI are female patients, prolonged duration of catheter insertion, diabetes, history of previous catheter insertion, and long duration of hospitalization (Li et al., 2018).

A study in Uganda reveals a higher percentage of bacteriuria in inpatients (57%) than that of outpatients (43%). Additionally, 59.2% of inpatients have an increased risk of UTIs due to catheter usage (Odoki et al., 2019). This suggests that catheter insertion has a role in increasing the risk of nosocomial UTI. In addition, data that supports the urgency of this study is data taken from the National Healthcare Safety Network (NHSN) regarding the incidence of CAUTI increasing by 5.6% per year in 2012-2014 (Soe et al., 2020).

In the present, there have been no research updates regarding CAUTI in Indonesia, especially in Surabaya. In addition, from the review above, there are differences in research results regarding risk factors for CAUTIs from several reading sources. Therefore, it is necessary to update research on risk factors for CAUTIs in order to determine what risk factors have an effect and future preventive measures.

Methods

This study was a cross-sectional study conducted in the department of internal medicine at a tertiary referral hospital in Surabaya. The study aims to determine the prevalence and risk factors for CAUTIs among inpatients in the period from May 2020 to May 2021. Data for this study were taken from electronic medical records.

The data taken is categorized into two groups of samples. The first group is the control group where patients who have not developed CAUTI after having an indwelling the catheter for at least 48 hours. The second group is the case group where patients developed CAUTI after having an indwelling catheter for at least 48 hours.

After adjusting to the available data in the medical record, the variables examined included age, gender, the patient's disease, and duration of hospitalization.

Each variable was categorized individually, as follows:

- Age categories are adulthood (26-45 years), elderly (46-65 years), and seniors (65 years and over).(Al Amin, 2017)
- Patient's disease variables are ≥median and <median where the median will be

discovered when the study is conducted.

- Duration of hospitalization are ≥median and <median with days as units where the median will be discovered when the study is conducted.

Data collection was carried out and subsequently split into two groups. Statistical comparison between the two groups was then done using the chi-square method.

Results

Data collection began with a search for UTI cases at the Internal Medicine installation for the period May 2020-May 2021 and a total of 64 patients were found to have UTIs. The search results were filtered again by looking for UTI patients who met the criteria that the UTI was caused by catheter insertion and found 21 patients. So, the proportion of catheter UTIs in internal medicine inpatients at a tertiary referral hospital in Surabaya for the period from May 2020 to May 2021 is 32.8%. The search for a control group started with cases of hypertension, diabetes, and malignancy at the Internal Medicine Installation for the period May 2020-May 2021 which are common diseases that people often suffer from. The search results were filtered again by looking for patients who had data on catheter insertion for at least 48 hours and 27 patients were taken who did not have a UTI.

a. Univariate Analysis

The distribution of variables is presented in Table 1.

Table 1. Variables Distribution

Variables	**N**	**%**
Age		
Young Adults	12	25%
Middle Age	27	56,3%
Elderly	9	18,8%
Gender		
Male	16	33,3%
Female	32	66,7%
Disease		
≥3	32	66,7%
<3	16	33,3%
Length of Stay		
≥12	24	50%
<12	24	50%

Age variables are categorized into adults (26-45 years), middle age (46-65 years), and elderly (> 65 years). The characteristics of the sample in this study ranged in age from 28 to 78 years with an average age of 54 years. The sample is dominated by the middle age category (56.3%). There were 16 men and 32 women who were sampled in this study. That indicated that the female sample dominated twice as much as the male.

Table 2. Disease Categorization

Disease	n
Plasma disorders and metabolism diseases	32
Respiratory diseases	30
Cardiovascular and hematology diseases	34
Renal diseases	13
Digestive disorders	4
Neurological diseases	10
Immunological disorders	2
Infection diseases	9
Liver diseases	7

The underlying disease or comorbidities in this study were categorized into nine categories listed in Table 2. The category with the highest number of cases was cardiovascular and hematology diseases. Based on the nine categories above, the sample is divided into two categories namely ≥3 dan <3. The number 3 is obtained from the median number of diseases suffered by the sample. In the variable duration of hospitalization, the CAUTI sample underwent treatment with a range of two days to 56 days. Meanwhile, non-CAUTI patients were treated with a range of four days to 41 days. The number 12 is obtained from the median of all the number of days of hospitalization of the patients who were the sample of this study.

b. Bivariate Analysis

The chi-square analysis result is presented in Table 3.

Table 3. Bivariate Analysis

Variables	CAUTI (%)	Non-CAUTI (%)	p
Age			
Young Adults	7 (33,3%)	5 (18,5%)	
Middle Age	11 (52,4%)	16 (59,2%)	0,465
Elderly	3 (14,3%)	6 (22,2%)	
Gender			
Male	4 (19%)	12 (44,4%)	0,064
Female	17 (81%)	15 (55,5%)	
Disease			
≥3	11 (52,4%)	21 (77,8%)	0,064
<3	10 (47,6%)	6 (22,2%)	
Length of Stay			
≥12	8 (38,1%)	16 (59,3%)	0,146
<12	13 (62%)	11 (40,7%)	

The age range for the CAUTI group in this study was 38 to 77 years, while the age range for the non-CAUTI group was 28 to 78 years. The largest sample is the non-CAUTI group in the middle age category. In the gender variable, the largest group was the female CAUTI sample, totaling 17 people (81%). More samples suffer from at least three diseases. More specifically, there are more samples in the non-CAUTI group that suffer from at least three diseases.

The sample in this study had an average and median of three underlying diseases or comorbidities. In CAUTI patients, 52.4% of patients had at least three underlying diseases or comorbidities and 47.6% of patients had less than three underlying diseases or comorbidities. In patients who

were not infected with CAUTI, it was found that 77.8% of patients had at least three basic diseases or co-morbidities, and 22.2% of patients had less than three underlying diseases or comorbidities. Almost all disease categories in this study found that these diseases were more common in patients who were not infected with CAUTI. Only the category of kidney disease and digestive disorders suffered more from the CAUTI group.

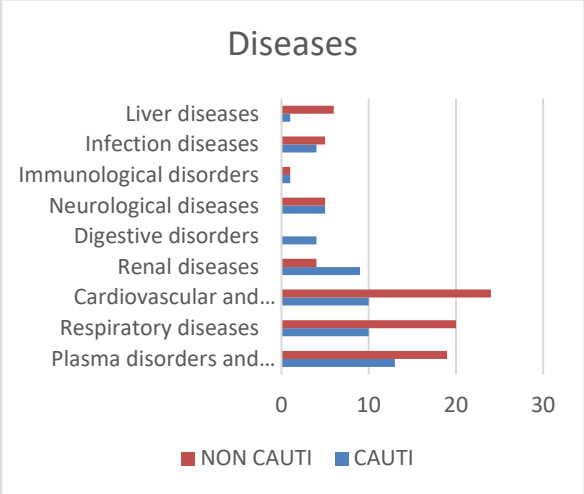

Figure 1. Distribution of diseases

Based on table 3, it is known that the p-value of the relationship between age and CAUTI status is 0.465 (p>0.05), p-value of the relationship between gender and CAUTI status is 0.064 (p>0.05), p-value of the relationship between disease and CAUTI status is 0.064 (p>0.05), and the p-value of the relationship between duration of hospitalization and CAUTI status is 0.146 (p>0.05). So there is no significant relationship between all variables and the incidence of CAUTI.

Discussion

A 2018 study conducted in Medan reports a prevalence of 44,4% for CAUTI (Anggi et al., 2019). Compared to this study which reported a prevalence of 38.2% a difference can be observed to be 6.2%. Meanwhile, a study in Saudi Arabia between 2020 and 2021 also exhibits a decrease of 6.2% in CAUTI prevalence (Alsaffar et al., 2023). This can happen because during the COVID-19 pandemic, there was a reduction in the number of operations in the hospital. Hospitals during the pandemic also focused on the overflowing patients. COVID-19 patients who have susceptible immune systems are also given broad-spectrum antibiotics to enable COVID-19 patients to avoid urinary bacterial infections. Reducing urine culture measures is also carried out to reduce contact with COVID-19 patients (Alsaffar et al., 2023; Fakih et al., 2022).

This study found no significant effect between certain age categories on the incidence of CAUTI in this study. The insignificant results obtained from this study could have occurred because of the small sample size or because patients who were recorded as not having a UTI did not have their urine culture examined, as well as the role of age range on immunity,

comorbidities, and others. There was a study conducted in South Korea at six hospitals which showed a relationship between age and the incidence of CAUTI of p=0.194 (Kim et al., 2017). A systematic review also supports the statement that age does not have a significant effect on the incidence of CAUTI (Li et al., 2018). However, a study conducted in the United States showed that there was an older mean age of patients with CAUTI, 58 years, compared to catheterized patients who did not have CAUTI, 53 years (Hagerty et al., 2015). There is even a study that states that for every one-year increase in age, there is an increase in the risk of suffering from CAUTI by 3% (Gillen et al., 2015).

This study also has not found other studies that found similar results found by this study, where patients of female or male gender did not have a significant association with the incidence of CAUTI. Several previous studies conducted in the United States found that women are a risk factor for CAUTI (Flores-Mireles et al., 2019; Gillen et al., 2015; Perrin et al., 2020). This can happen because females have a shorter urethra, also the distance from the anus to the opening of the urethra is shorter than males, allowing the transfer of uropathogenic bacteria from the digestive tract to the urinary tract (Flores-Mireles et al., 2019). Such female anatomy makes females have a higher risk of contracting a UTI. Meanwhile, several other studies such as those conducted in South Korea, China, and Saudi Arabia, found that males are the sex that experiences CAUTI more often (Deltourbe et al., 2022; Kim et al., 2017; Saleem et al., 2022). A study explains that this can occur due to urodynamic changes. Urodynamic changes, for example, prostatic hypertrophy and bladder outlet obstruction. A meta-analysis study stated that the lifetime risk of uncircumcised men getting a UTI was 32%, while that of uncircumcised men was 8.8% (Morris & Wiswell, 2013).

A study states that prolonged hospitalization after catheterization usually has serious co-morbidities that make patients more susceptible to infection as well as increased antibiotic resistance and death (Liu et al., 2020). The results of previous studies found that almost all of them showed significant results between the duration of hospitalization and CAUTI, where the longer the duration of the patient's hospitalization, the higher the risk of CAUTI (Flores-Mireles et al., 2019; Gillen et al., 2015; Hagerty et al., 2015).

Unlike previous studies, there was no significant effect of the duration of hospitalization and the number of CAUTI cases in this study. It is known that several samples did not complete treatment at the hospital as recommended or were called forced discharge and some other samples

were also known to have died. 11 samples who forced to be discharged and/or died in this study. The duration of hospitalization that researchers found in this sample has a very wide range from one another. A study in Saudi Arabia stated that the recommendation for placing a urinary catheter should be no more than 3-8 days (AL-Hazmi, 2015). Based on this statement, it is possible for patients in the category of less than 12 days that exceeded eight days of catheter insertion to experience a UTI. It is also possible that a patient who has been hospitalized for at least 12 days has a UTI but is asymptomatic and therefore does not have a urine culture done.

A previous study conducted in America showed that there were other diseases that were not found in this study sample, namely hyperglycemia in patients with subarachnoid hemorrhage and the Intensive Care Unit (ICU) which were found to have a strong association with CAUTI (Hagerty et al., 2015). The same study also stated that anemia requiring transfusion was also had a relationship with the incidence of CAUTI. Research by Liu et al. (2020) found several other diseases suffered by CAUTI patients, including chronic respiratory disease, chronic liver disease, congestive heart failure, solid tumors, septic shock, hypoproteinemia, and immunosuppression. Among the diseases that have been mentioned in this study, a disease that has a significant effect on CAUTI is congestive heart failure (Liu et al., 2020). The research was conducted in the Internal Medicine ward of the tertiary referral hospital in Surabaya and found that there was no relationship between the number of underlying diseases or comorbidities affecting the incidence of CAUTI. Researchers have not found other studies that examine the relationship between the number of underlying diseases or comorbidities with the incidence of CAUTI. Further analysis is needed regarding the relationship between each underlying disease or comorbidity to CAUTI.

While we found no significant risk factors for CAUTI, research by Gray et al (2023) presented a few methods that can minimize the occurrence of CAUTI. These methods vary from interventions in protocol, changes in protocol, or the use of reminders.

These methods include a daily interdisciplinary huddle on catheter safety, a daily catheterization review on patients, and the use of a checklist in catheterization. Additionally, a team consisting of two nurses can reduce errors by having one insert a catheter and the other person do the checklist.

Conclusion

Results from the study reveal that a notable number of patients at internal

medicine at a tertiary referral hospital in Surabaya experienced Catheter-Associated Urinary tract Infections (CAUTI). However, after analyzing patient characteristics, disease, and hospital treatment, no variable was found to be a risk factor for CAUTI itself.

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Primary Percutaneous Coronary Intervention in a 24-hour PCI Capable Hospital in Indonesia

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ABSTRACT

Introduction: Chest pain may be a symptom of a life-threatening disease such as S ST-Elevation Myocardial Infarction (STEMI). Immediate primary percutaneous coronary intervention (PPCI) is recommended for virtually all STEMI patients who present in a PCI-capable hospital.
Objective: We would like to present data on Door-to-Balloon (DTB) times and the factors affecting it.
Methods: This is a single-center retrospective study. Patients are STEMI patients, undergoing primary PCI from 1st January 2024 to 30th April 2024. Secondary data are obtained from the medical records and analyzed.
Results: A total of 60 patients undergo PPCI during the study period. Patients are generally male patients, aged 53.67 years old, with 2 traditional cardiovascular risk factors, presenting to the emergency department (ED) with an average of 5.88 hours of chest pain. DTB time was 86.25 minutes during the study period. We identified the onset of chest pain and referred patients to be associated with DTB time. Referred patients had longer onset since chest pain but faster DTB time. We found no association between age, gender, presenting time, diagnosis, Killip class, and physician factor to significantly affect DTB time.
Conclusions: We have identified factors that may help us improve our DTB time. Patient knowledge should also be improved to increase awareness of symptoms of chest pain, minimizing patient delay and improving total ischemic time.

Introduction

Chest pain is one of the most frequent complaints encountered in emergency departments and can signal a potentially life-threatening condition, such as acute coronary syndrome (ACS). Prompt identification and management are crucial, especially in ST-Elevation Myocardial Infarction (STEMI) cases, where timely reperfusion can significantly improve outcomes. For patients with STEMI, the recommended treatment includes either fibrinolytic therapy or invasive interventions such as primary percutaneous

coronary intervention (PCI) (Byrne et al., 2023).

To assist clinicians in delivering optimal care, current clinical guidelines recommend primary PCI as the preferred method of reperfusion for nearly all STEMI patients presenting to PCI-capable facilities (Byrne et al., 2023; Neumann et al., 2019). Delays in initiating reperfusion therapy are strongly linked to increased mortality, underscoring the need for swift action (Alrawashdeh et al., 2021). This study was conducted to evaluate the door-to-balloon (DTB) times in a PCI-capable hospital and to identify clinical and system-related factors that may influence these timings. By assessing local performance and associated factors, we aim to explore potential areas for improvement in STEMI care within our center.

Methods

This is a single-center retrospective cohort study. We analyzed the cath lab report of patients undergoing immediate Primary PCI from 1st January 2024 to 30th April 2024, The data was obtained from the electronic medical record system of a single PCI-capable hospital in West Java, Indonesia. The data obtained are secondary, consisting of patient characteristics, emergency department (ED) diagnosis, onset of chest pain in our emergency department, and cardiovascular risk factors.

We also extracted the cath report for these patients and calculated their door-to-balloon (DTB) time, culprit vessel, and documented the reason for prolonged DTB time. We analyzed the data using the SPSS application. Inclusion criteria were adult patients (aged $\geqslant$18 years) diagnosed with ST-elevation myocardial infarction (STEMI) who received primary PCI during the study period. Patients were excluded if they had incomplete data, were diagnosed with non-STEMI, or underwent PCI more than 24 hours after symptom onset.

Data were analyzed using the SPSS application. Descriptive statistics were used to summarize patient characteristics. Univariate analysis (Chi-square and ANOVA tests) was performed to identify factors affecting DTB. Variables with $p < 0.1$ were considered for multivariate analysis to control for confounders. This study is under the Declaration of Helsinki and is approved by the local ethical review board.

Results and Discussion

During the study period, a total of 60 patients underwent immediate primary PCI. All patients presented with STEMI. Patient characteristics are summarized in Table 1. The mean age was 53.67 years, with a predominantly male population. Most patients had at least two traditional cardiovascular risk factors and presented to

the emergency department (ED) an average of 5.88 hours after symptom onset. Data on standard deviation were not available due to limitations in the secondary data set.

Table 2 presents detailed findings from the coronary angiography reports, including door-to-balloon (DTB) times and procedural details. In this study, the emergency physician (referred to as "physician") was responsible for initial stabilization, while the "operator" was the interventional cardiologist performing the PCI. Notably, 75% of patients had significant coronary stenoses beyond the culprit lesion. Reasons for DTB delays exceeding 120 minutes were also documented (see Table 2).

Patients were divided based on time of presentation: 20 patients (33.3%) arrived during office hours (07:00–16:00), and 40 patients (66.7%) during off-hours (16:00–07:00). STEMI patients require immediate revascularization, and minimizing delays is critical to reducing morbidity and mortality (Alrawashdeh et al., 2021).

Table 1. Characteristics of patients presenting to the emergency department with STEMI

Patient Characteristics (n = 60)	n	(%)
Age (mean = 53.67)		
<40	5	8.3
40-49	19	31.7
50-59	17	28.3
60-69	13	21.7
>70	6	10
Gender		
Male	56	93.3
Female	4	6.7
Diagnosis		
Anterior	16	26.7
Anteroextensive	19	31.7
Inferior	15	25
Inferior + Right	2	3.3
Inferolateral	1	1.7
Inferoposterior	5	8.3
Inferoposterior + Right	2	3.3
Onset of Chest Pain		
<3h	16	26.7
3-6h	21	35
>6h	23	38.3
Killip Class		
1	35	58.3
2	21	35
3	0	0
4	4	6.7
Referred?		
Yes	29	48.3
No (walk-in)	31	51.7
Risk Factors		
Hypertension	28	46.7
Diabetes	13	21.7
Dyslipidaemia	18	30
Smoking History	40	66.7
Active Smoker	35	58.3
Ex-Smoker	5	8.3
Family History of CAD	12	20
Menopause	2	3.3

Table 2. Cath report details and findings

Physician (General Practitioner)	n	%

A	6	10
B	3	5
C	6	10
D	6	10
E	7	11.7
F	3	5
G	6	10
H	3	5
I	20	33.3
Operator (Interventional Cardiologist)		
1	26	43.3
2	23	38.3
3	10	16.7
4	1	1.7
Door-to-Balloon Time	(mean = 86.25 mins)	
≤60 mins	12	20
61 - 90 mins	29	48.3
91 - 120 mins	11	18.3
>120 mins	8	13.3
Stents Used		
POBA only	3	5
DEB only	1	1.7
DES only	48	80
DES + POBA	1	1.7
DES + DEB	1	1.7
DESx2	6	10
Culprit Vessel		
LAD	35	58.3
LCx	1	1.7
RCA	24	40
Vessel Disease		
1	15	25
1 + LM	2	3.3
2	13	21.7
2 + INT	1	1.7
2 + LM	3	5
3	22	36.7
3 + INT	1	1.7
3 + LM	2	3.3
3 + INT + LM	1	1.7
Delayed Reasons	**16**	**16.7**
Cardiac Arrest	2	3.3
Patient Consent	7	11.7
Puncture	2	3.3
Queueing	5	8.3
Intra-PCI Complications	**4**	**6.7**
Arrest in cathlab	1	1.7
Dissection	2	3.3
Stent Dislodgement	1	1.7

Recent recommendations from the European Society of Cardiology (ESC) suggest aiming for a reperfusion time (wire-crossing) of less than 60 minutes in PCI-capable centers and a target PCI time of under 120 minutes for patients referred from non-PCI centers (Byrne et al., 2023; Neumann et al., 2019). Traditionally, a "Door-to-Balloon" (DTB) time of 90 minutes was the standard, but this was revised in the 2017 ESC Guidelines, with the term DTB being replaced by wire-crossing time (WCT) and the target time shortened to less than 60 minutes.(Ibanez et al., 2018) Although recent guidelines use wire-crossing time (WCT), in our center the term ‘door-to-balloon time’ (DTB) is still used as the practical marker of reperfusion timing.

Globally, PCI centers have made significant improvements in reducing door-to-balloon (DTB) times. Minimizing delays

in reperfusion is crucial for managing STEMI patients (Fabris et al., 2020). The implementation of STEMI networks in Europe and the United States has greatly enhanced reperfusion times and serves as a model for other nations, particularly in developing countries where DTB times are often suboptimal (Dharma, 2020; Krumholz et al., 2011). In Brazil, a median DTB time of 104 minutes has been reported (Amoras et al., 2020). In an Indian tertiary care center, the original DTB time of 121 minutes was reduced to 101 minutes after addressing system delays (Prakash et al., 2022). In a local hospital in the Philippines, the average DTB time was found to be 126 minutes (Toledano et al., 2023).

In our current study, we found that the majority of STEMI patients presenting to our emergency department are males in their 4^{th} to 5^{th} decade of life, with an average chest pain onset of 5.88 hours, however, standard deviation was not available due to the nature of secondary aggregated data. Furthermore, all but one patient (n = 59, 98.3%) had identifiable risk factors for coronary artery disease (CAD), with smoking history being the most common, followed by hypertension. Our mean door-to-balloon (DTB) time was calculated to be 86.25 minutes (data on variability not available), as shown in Table 2, which meets the target DTB time of 90 minutes.

We conducted a univariate analysis to identify factors that influence door-to-balloon (DTB) times (Table 3). Our analysis revealed that Killip Class, the emergency physician, and the attending interventional cardiologist did not significantly affect DTB times (Figure 1). It is noteworthy that Physician I managed a higher number of STEMI patients (n = 20), which is attributable to Physician I's longer work hours in the emergency department compared to other physicians. In the emergency department, late or misdiagnosis is a known cause of delayed DTB, making the emergency physician a crucial factor, as delayed STEMI diagnosis can lead to system delays, ultimately impacting DTB times (Emami et al., 2023; Li et al., 2018; Martí et al., 2014). Additionally, our findings suggest that patients presenting during office hours had longer DTB times compared to those presenting during off-duty hours, although the difference was not statistically significant (Office Hours: 94 min, Off Duty Hours: 82.38 min, p = 0.086). Based on this data, we observed a longer DTB during office hours, which contrasts with findings from other studies (Hsiao et al., 2023).

Table 3. Univariate analysis of variance on factors affecting door-to-balloon time

Univariate Analysis	p-value
Gender	0.836
Age	0.916
Diagnosis	0.53
Onset	0.003*
Killip Class	0.074
Referral	0.004*
Presenting Time	0.086
Physician	0.593
Operator	0.94
Culprit Vessel	0.593
PCI Complication	0.298
*Significant value (p <0.05)	

Our findings also indicate that patients referred to our center had significantly shorter DTB times compared to those who presented directly to the emergency department (Referred: 77.03 minutes, ED: 94.87 minutes, p = 0.002). This suggests that streamlining referral systems, including early activation of cath lab and pre-hospital consent, may help reduce system delay in direct arrivals as well. Additionally, referred patients tended to have later onset of symptoms than those who were not referred (Referred: 7.36 hours, ED: 4.5 hours, p < 0.001) (Figure 2). Similarly, a study by Liu et al. found that patients arriving by ambulance had shorter DTB times (Liu et al., 2021; Y. H. Park et al., 2012). A possible explanation for this finding is that informed consent is often obtained at the referring hospital, so referred patients are already aware of their condition and future treatment plans, which may reduce delays in the emergency department and shorten the time needed for patient consent.

As half of our patients (n = 29, 48.3%) were referred from another hospital, and since our study does not account for hospital transfer times, this may influence the results. The time spent at the originating hospital (door-in, door-out time) is not included in our analysis, and based on our experience, this process can take a considerable amount of time, making it a potential confounding factor. Similarly, hospital transfer times, such as the duration spent in the ambulance, were not recorded or analyzed, though they are often identified as a cause of delayed DTB (Amoras et al., 2020; J. H. Park et al., 2016). This pre-admission delay likely contributes to the difference in chest pain onset between referred patients and those arriving independently at our ED, potentially affecting the total ischemic time. The significantly shorter DTB time in referred patients highlights a key opportunity by adopting pre-hospital processes such as pre-consent, ambulance triage protocols, or direct cath lab activation, even non-referred patients might benefit from reduced reperfusion times.

Improving system delays and establishing a STEMI network in our region could help reduce patients' total ischemic

times and decrease morbidity. In 2010, the United States successfully implemented a STEMI network, which resulted in a reduction of STEMI DTB times from 94 minutes to 64 minutes (Krumholz et al., 2011). This approach was previously demonstrated on a smaller scale in Indonesia by Fadlan et al., who found that implementing a STEMI network in their tertiary care center helped reduce ischemic time, DTB times, and in-hospital mortality (Rizki Fadlan et al., 2022).

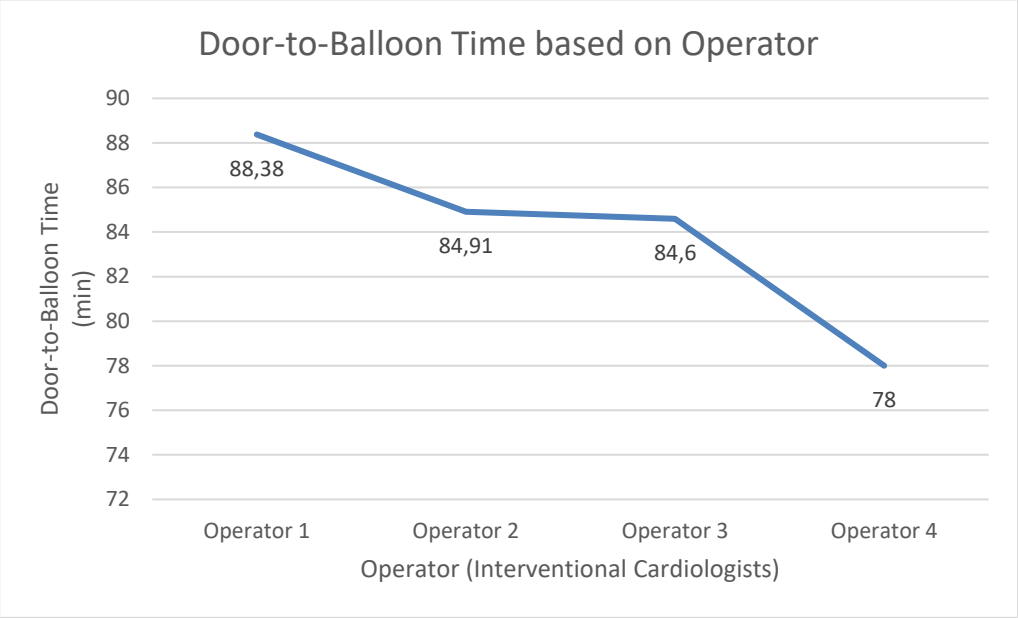

Figure 1. Door-to-balloon time based on operator

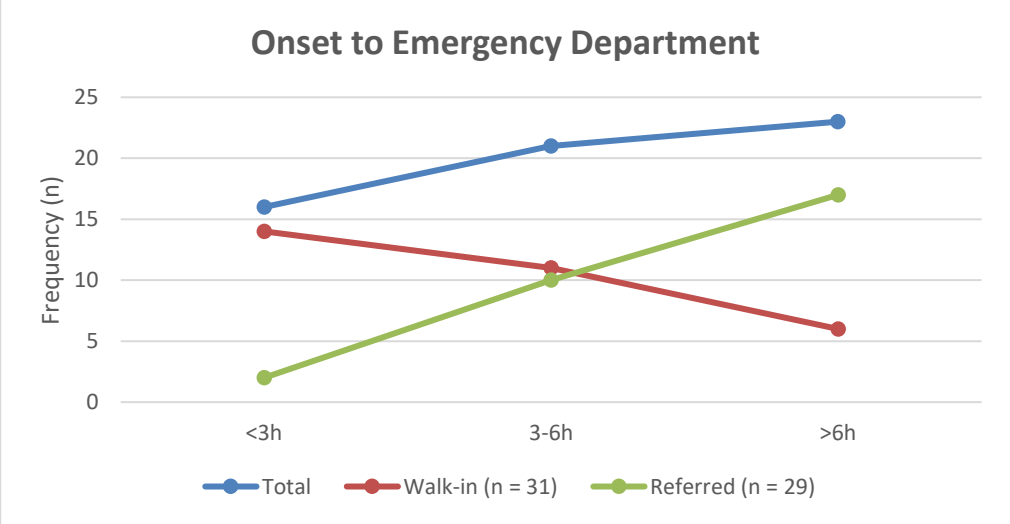

Figure 2. Time from symptom onset to our emergency department

Lastly, when excluding patients with delayed DTB times due to delays in obtaining consent, we observed an improved DTB time of 82.6 minutes. Our average onset of chest pain is also notably longer compared to that in other countries

(Martí et al., 2014; Y. H. Park et al., 2012). This patient delay is included in the total ischemic time and may impact patient prognosis, as most life-threatening arrhythmias occur during the first few hours of a myocardial infarction (Karam et al., 2019; Shah et al., 2021). Therefore, increasing patient awareness of the signs and symptoms of a heart attack, as well as the potential adverse outcomes of not seeking medical treatment, is crucial for improving patient outcomes (Y. H. Park et al., 2012).

Conclusion

Although we are able to achieve DTB times of < 90 minutes, improvements in DTB time are always a target to strife for. Through this study, we have identified possible options and methods to further improve our DTB time in our hospital. We would also like to see improvements in the referral systems and possibly a STEMI network in our region. Another thing to note is the importance of increasing patient awareness of signs and symptoms of heart attack to improve total ischemic time and aim to decrease morbidity and mortality in relation to heart diseases.

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Correlation Between Workload and Burnout of Educational Staff Faculty of Medicine Universitas Nahdlatul Ulama Surabaya

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ABSTRACT

Introduction: High workload among educational staff may adversely impact mental health, leading to stress, fatigue, and anxiety. In academic settings, particularly in medical faculties, complex task demands often result in psychological pressure. This study is essential to understand whether workload influences the mental health of educational staff at the Faculty of Medicine Universitas Nahdlatul Ulama Surabaya (FK UNUSA).
Objective: This study aims to analyze the relationship between workload and mental health (burnout) among educational staff at the FK UNUSA.
Methods: This quantitative study employed a survey approach. Data were collected using standardized questionnaires measuring two main variables: workload (NASA-TLX) and burnout (Maslach Burnout Inventory). A total of 21 educational staff members participated. Statistical analysis was conducted using the Spearman Rank correlation test to examine the relationship between the two variables.
Results: The findings indicate a significant correlation between workload and mental health (p = 0.016). Educational staff with higher workloads tended to experience burnout. However, at the FK UNUSA, most educational staff reported mild to moderate workloads, while their mental health conditions were generally categorized as low to moderate burnout.
Conclusions: A significant relationship exists between workload and burnout among educational staff at the FK UNUSA (p-value = 0.016). Although workload is an important factor, it does not act alone. Other contributing factors, such as social support, emotional stress, and work environment, also play critical roles in determining burnout levels.

Introduction

Education serves as the cornerstone of national development and plays a crucial role in enhancing the intellectual capacity of society (Sari, 2021). In Indonesia, medical education holds a central position in producing competent and high-quality human resources, in line with the increasing global demand for healthcare professionals. Within this context, the Faculty of Medicine at Universitas Nahdlatul Ulama Surabaya (FK UNUSA) bears a significant

responsibility in preparing qualified future doctors. However, the success of education is not solely determined by the quality of lecturers, curriculum design, or supporting infrastructure; it also heavily depends on the welfare and mental health of educational staff who support and maintain the continuity of educational processes.

Educational staff are an integral part of the educational system but are often overlooked. In an era marked by rapid advances in science and technology, the quality of education also relies on the readiness of educational personnel who are healthy both physically and mentally. Their well-being is essential for maintaining the operational stability of academic institutions, including in high-demand environments such as the FK UNUSA. Therefore, it is important to understand the factors that influence the well-being of educational staff, one of which is workload.

Workload is recognized as a significant variable affecting individual performance. While other factors such as compensation, work environment, job satisfaction, organizational commitment, communication, and work motivation also play important roles (Fitri Sopali et al., 2022). According to Sutoyo et al. and Stefani & Kosasih (Stefani & Kosasih, 2024; Sutoyo et al., 2018), workload encompasses physical, mental, and temporal dimensions, and when excessive, can lead to prolonged stress. Burnout is characterized by emotional exhaustion, depersonalization, and a reduced sense of personal accomplishment. These symptoms, including chronic fatigue, feelings of failure, sadness, and loss of motivation, ultimately harm both the psychological and physical health of educational staff (Carducci et al., 2020; Jha et al., 2020).

The relationship between workload and burnout creates a negative cycle that reinforces itself. High workload generates psychological strain, and the resulting burnout can reduce work performance, lower productivity, and damage interpersonal relationships in the workplace (López-Núñez et al., 2020). This cycle makes it difficult for educational staff to recover and can impact the overall quality of educational services.

To explain this phenomenon, the Job Demands-Resources (JD-R) model provides a strong theoretical framework. This model highlights that burnout arises from an imbalance between high job demands and limited available job resources. In the education sector, job demands may include heavy workloads, administrative responsibilities, student disciplinary issues, and time pressure to complete curricula and assessments (Granziera et al., 2021).

Conversely, the presence of job resources such as teaching autonomy, peer and supervisor support, and opportunities for professional development can serve as protective factors against burnout. Personal resources, including adaptive coping skills, resilience, and self-efficacy, also significantly influence individual responses to work-related stress (Varma & Sivarajan, 2023). However, experiences of workload and access to resources vary depending on individual characteristics and institutional culture (Cheng et al., 2023). Therefore, contextual, and locally relevant interventions are necessary.

Based on the background above, this study was conducted to examine the relationship between workload and burnout among educational staff at the Faculty of Medicine UNUSA. The findings are expected to provide a comprehensive understanding of the factors that affect the psychological well-being of educational staff and to serve as a foundation for designing strategic interventions aimed at fostering a healthy and productive work environment. Enhancing the well-being of academic staff is expected to contribute positively to the overall quality of medical education in Indonesia.

Methods

This study employed a quantitative analytic design with a cross-sectional approach. The research was conducted at the FK UNUSA, involving a total of 21 educational staff as respondents. Data collection was carried out using questionnaires: the NASA Task Load Index (NASA-TLX) for measuring workload and the Maslach Burnout Inventory (MBI) for assessing burnout.

NASA-TLX

According to Saddam and Handayani (Saddam Akbar & Handayani, 2022), the NASA-TLX questionnaire is one of the most widely used methods for measuring mental workload. Participants respond to the questionnaire as a means of evaluating subjective workload with a tool that is accessible and sensitive to different task demands. In essence, the NASA-TLX is a method for analyzing mental workload by asking respondents about several key factors that influence their job. It includes six workload indicators: mental demand, physical demand, temporal demand, performance, effort, and frustration level.

The first step in analyzing workload using the NASA-TLX method involves calculating the score for each aspect by multiplying the rating by the respective weight of each indicator:

Aspect Score = Rating × Indicator Weight

Once scores for all six aspects are obtained, the next step is to calculate the Weighted Workload (WWL) by summing all the aspect scores:

WWL = Σ Aspect Scores

The final NASA-TLX score is then calculated by dividing the WWL by the total weight value (15):

NASA-TLX Score = WWL / 15

Based on the final score, workload levels are classified into three categories:

- Mild workload: score < 50
- Moderate workload: score between 50–80
- Severe workload: score > 80

Maslach Burnout Inventory (MBI)

The Maslach Burnout Inventory is an essential tool for identifying burnout syndrome. It evaluates three key dimensions: emotional exhaustion, depersonalization, and personal accomplishment (Sayapathi & Rowther, 2022). Each dimension has a specific score threshold that indicates the severity of burnout:

- Emotional Exhaustion (EE): score > 27 indicates high emotional exhaustion and a significant risk of burnout.
- Depersonalization (DP): score > 10 reflects high levels of depersonalization, often marked by cynical attitudes toward others.
- Personal Accomplishment (PA): score < 33 indicates a low sense of personal accomplishment, often linked with burnout symptoms.

This study was conducted by the ethical principles outlined in the Declaration of Helsinki. All procedures involving human participants received approval from the Ethics Committee of Universitas Nahdlatul Ulama Surabaya, with approval letter number: 0189/EC/KEPK/UNUSA/2024.

Before data collection, all participants were informed of the study's objectives, benefits, risks, and their rights to decline or withdraw from participation without any consequences. Written informed consent was obtained voluntarily from all participants. The confidentiality of the data was maintained, and all information was used solely for research purposes. Participants identities were anonymized and will not be disclosed in any form.

The questionnaires used were standardized instruments and thus were not subjected to validity or reliability testing in this study. The collected data were analyzed using univariate statistics and the Spearman Rank correlation test (Saputeri et al., 2023) to assess the relationship between workload and burnout.

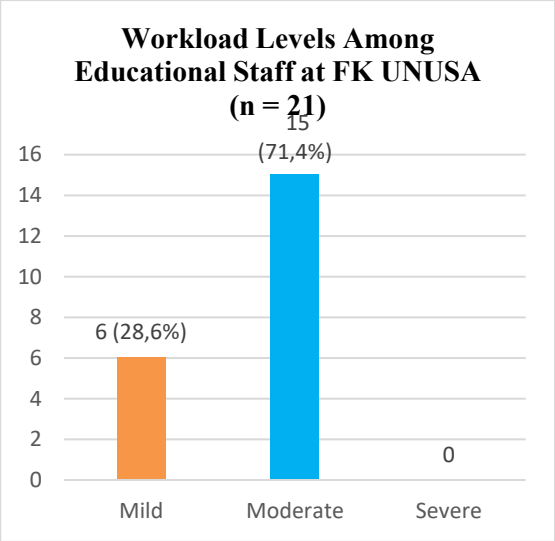
Results and Discussion

Most respondents in this study were aged between 26–30 years and were predominantly female with a bachelor's degree education level (Table 1). In terms of workload, most respondents reported experiencing a moderate level of workload, while the remainder (28.6%) reported a mild workload. No respondents were classified as experiencing a severe workload (Figure 1). Regarding burnout levels, most respondents exhibited low burnout (57.1%), while the remaining 42.9% were categorized as experiencing a tendency toward burnout (Figure 2).

Table 1. Respondent Characteristics

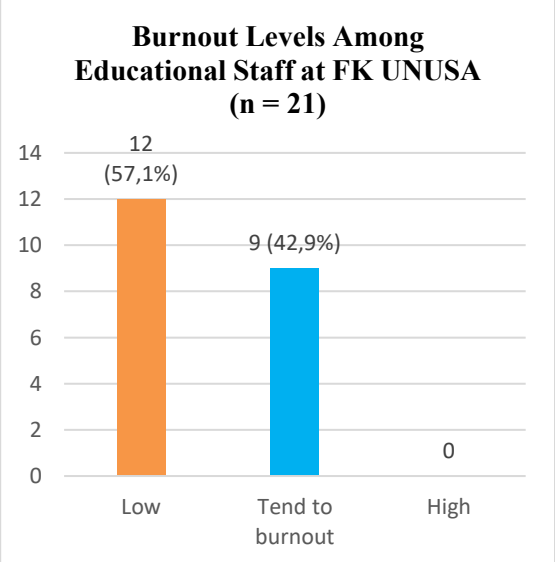
Respondent Characteristics	Frequency	
	n	%
Age		
21-25 Years	2	9.5
26-30 Years	10	47.6
31-35 Years	7	33.3
36-40 Years	2	9.5
Gender		
Man	8	38.1
Woman	13	61.9
Education		
Vocational School (SMK)	1	4.8
Diploma (D3)	4	19
Bachelor's (S1)	15	71.4
Master's (S2)	1	4.8
Position		
Head	3	14.3
Admin	7	33.3
Staff	11	52.4
Total	**21**	**100**

Note: 57.1% of respondents exhibited low burnout levels (n = 12)



Note: 71.4% of respondents reported experiencing moderate workload levels (n = 15).

Figure 1. Workload Levels Among Educational Staff at FK UNUSA



Note: 57.1% of respondents exhibited low burnout levels (n = 12)

Figure 2. Burnout Levels Among Educational Staff at FK UNUSA

Table 2. Relationship Between Workload and Burnout Among Educational Staff at FK UNUSA

Workload		*Burnout level*			Total	P Value
		Low	Tend to burnout	High		
Mild	n	1	5	0	6	0.016
	%	16.7%	83.3%	0%	100.0%	
Moderate	n	11	4	0	15	
	%	73.3%	26.7%	0%	100.0%	
Severe	n	0	0	0	0	
	%	0%	0%	0%	0%	
Total	n	12	9	0	21	
	%	57.1%	42.9%	0%	100.0%	

Note: There is a statistically significant relationship between workload and burnout (p = 0,016).

Based on the Spearman correlation analysis presented in Table 2, there is a statistically significant relationship between workload and burnout (p = 0.016). However, the distribution of burnout does not fully align with workload levels. Notably, 5 out of 6 respondents with mild workloads tended to burnout. Conversely, the majority (73.3%) of respondents with moderate workloads experienced low burnout levels.

These findings indicate that burnout is not solely determined by workload intensity but is also influenced by factors such as individual perceptions of work, emotional demands, and the availability of social support. This aligns with the Job Demands-Resources (JD-R) model, which suggests that high job demands do not necessarily lead to burnout if sufficient resources are available (Santoso & Hartono, 2018). In this context, respondents with moderate workloads may have benefited from a supportive work environment, whereas those with lighter workloads but higher burnout may have faced unfavorable psychosocial conditions.

This analysis reinforces the need for a deeper understanding of contextual and psychological factors in addressing burnout in educational settings. The results also imply that interventions should not focus solely on reducing workload but must also include strengthening protective factors such as supportive leadership, coping skills training, and cultivating a healthy workplace culture.

Workload Among Educational Staff

The results of this study revealed that most educational staff at the Faculty of Medicine, Universitas Nahdlatul Ulama

Surabaya (FK UNUSA) experienced a moderate level of workload (n = 15), while six participants reported mild workload levels. These findings suggest that although most educational staff were not burdened with excessive workload, it remains essential to understand the underlying factors that shape their perceptions of workload.

Perceived workload among educational staff can be influenced by various factors, including human resource management and the work environment. Research has shown that effective management of educational personnel can improve both the quality of education and job satisfaction (Mutmainah et al., 2022; Sanda et al., 2022). For instance, the managerial competence of faculty leadership in managing curriculum and staff plays a crucial role in creating a supportive work environment, which in turn affects staff perceptions of their workload (Supriadi et al., 2022).

Additionally, awareness of work behavior may also influence workload perceptions. Studies have indicated that innovative work behavior among educational staff can help them manage their tasks and responsibilities more effectively, thus reducing perceived pressure (Hardianto et al., 2021). Therefore, training and professional development are vital in enhancing staff capacity to cope with their job demands (Ria & Kurniati, 2022).

Burnout Among Educational Staff

According to the findings, a considerable number of educational staff at FK UNUSA exhibited signs of burnout, with 9 respondents showing a tendency toward burnout and 12 experiencing low levels. Understanding the contributing factors to this phenomenon is essential. Burnout among educational staff may be triggered by various factors such as excessive workload, lack of social support, and dissatisfaction with the work environment (Agyapong et al., 2022; Wisdom, 2023).

Burnout is characterized by emotional exhaustion, depersonalization, and a reduced sense of personal accomplishment (Alfazari et al., 2022). Research shows that excessive workload is often a primary contributor to burnout in educational settings. Staff are frequently confronted with high demands in both teaching and administrative tasks, leading to stress and fatigue. Furthermore, inadequate support from management and peers can exacerbate this condition, increasing the risk of burnout (Cao & Naruse, 2018).

Another key factor is job dissatisfaction. Studies indicate that staff who are dissatisfied with their working conditions including salary, opportunities for development, and workplace relationships

are more vulnerable to burnout (Jeffrey et al., 2022; Rees et al., 2019). Therefore, educational institutions must foster supportive work environments and provide appropriate recognition to motivate and value their staff (Fynn & Walt, 2023).

Correlation Between Workload and Burnout Among Educational Staff

The results showed that one respondent with a mild workload experienced low burnout, while five others with mild workloads showed a tendency toward burnout. Among those with moderate workloads, most (11 individuals) reported low burnout, while four showed signs of potential burnout. These findings indicate a complex relationship between workload and burnout among educational staff at FK UNUSA.

Previous studies suggest that high workload contributes to increased burnout risk, particularly in healthcare settings such as nursing (Nurmawati et al., 2022). Similarly, in this study, respondents with moderate workloads still exhibited burnout tendencies, albeit to a lesser extent. This suggests that even moderate workloads may lead to burnout if accompanied by other factors such as stress or lack of social support (Wardah & Tampubolon, 2020).

Interestingly, some respondents with mild workloads still experienced burnout. This highlights that burnout is not solely driven by workload levels but also by psychological and emotional factors. Earlier research has also shown that job-related stress can affect caring behavior, which may contribute to burnout (Kurniyanti, 2015). Thus, even in cases of light workload, emotional strain and lack of support play significant roles in shaping burnout experiences.

Conversely, the fact that most respondents with moderate workloads reported low burnout suggests the presence of protective factors. For example, Sari (Resmi Sari et al., 2023) found that while work-related stress may not directly correlate with burnout, a positive work environment and peer support can mitigate its effects. Therefore, fostering a supportive workplace and providing emotional support to staff can be effective strategies for reducing burnout risks.

Overall, the correlation between workload and burnout among educational staff at FK UNUSA indicates that while workload is an important factor, it does not operate in isolation. Other factors, such as emotional stress, social support, and the work environment, are also crucial in determining burnout levels. A holistic approach that considers all these factors is essential for managing and reducing burnout among educational staff.

Conclusion

This study concludes that there is a significant correlation between workload and burnout among educational staff at the FK UNUSA ($p = 0.016$). While workload is an important contributing factor to burnout, it does not act alone. Other elements such as social support, emotional stress, and the work environment also play a significant role in shaping burnout levels.

This study is limited by its small sample size ($n = 21$), which restricts the generalizability of the findings to larger populations. Additionally, the use of a cross-sectional design only allows for the observation of relationships at a single point in time and cannot establish causality between variables. Future research is recommended to include larger and more representative samples and to consider using longitudinal or experimental designs to better understand the dynamics of the variables involved. Such approaches will enhance the external validity of the findings and strengthen the basis for developing more targeted and effective interventions.

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Hemoglobin Levels in Pregnant Women: A Cross-Sectional Study at Puskesmas Purwokerto Timur II, Indonesia

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ABSTRACT

Introduction: Hemoglobin is a crucial protein in red blood cells responsible for transporting oxygen and carbon dioxide throughout the body. According to the World Health Organization (WHO), an estimated 41.8% of pregnant women worldwide experienced iron deficiency anemia in 2012. In Indonesia, the prevalence of anemia among pregnant women remains high at 37.1%, with Banyumas District reporting an even higher rate of 50.7% in 2016.
Objective: This study aimed to assess hemoglobin levels in pregnant women attending the Puskesmas Purwokerto Timur II, Banyumas District.
Methods: A descriptive observational study with a cross-sectional design was conducted from April to May 2021. Data collection included respondent identity and medical history through questionnaires, while hemoglobin (Hb) levels were measured using the Azidemet method with the POCT (Point of Care Testing) device. A purposive sampling technique was employed, enrolling 20 respondents.
Results: The results showed that 95% (19 out of 20) of the participants had normal hemoglobin levels. The mean Hb levels were 13.929 ± 0.6047 mg/dL in the first trimester, 11.500 ± 1.7804 mg/dL in the second trimester, and 13.067 ± 0.8501 mg/dL in the third trimester.
Conclusions: Overall, none of the pregnant women included in the study were diagnosed with anemia.

Introduction

In 2012, the World Health Organization (WHO) estimated that 41.8% of pregnant women worldwide experienced iron deficiency anemia. In Indonesia, the prevalence of anemia among pregnant women remains high at 37.1%, while in Banyumas Regency, the rate exceeded the national average, reaching 50.7% in 2016. These figures highlight the urgent need for enhanced efforts to address anemia in pregnant women (Purwati & Noviyana, 2018). The Health Office has implemented various measures to prevent anemia in pregnant women, including the routine provision of folic acid and iron supplements for a specific duration to help increase hemoglobin levels (Rizki et al., 2018).

Hemoglobin plays a crucial role in maintaining the biconcave shape of red

blood cells, ensuring their optimal passage through capillaries. Any disruption in this shape can hinder blood flow efficiency. Hemoglobin level assessment is a fundamental component of routine blood tests, serving as a key diagnostic tool for identifying various health conditions. It helps detect hemoglobin deficiencies, commonly known as anemia (Yusniati, 2019), and monitors the progression of diseases related to anemia and polycythemia (Wirahartari et al., 2019).

According to data from the Centers for Disease Control and Prevention (CDC), hemoglobin (Hb) levels in healthy pregnant women tend to decline during the first trimester (normal Hb >11 g/dL, Hct >33%), reaching their lowest point at the end of the second trimester (normal Hb >10.5 g/dL, Hct >32%), before gradually increasing again in the third trimester. Hb testing is recommended at least twice during pregnancy, specifically in the first and third trimesters. This approach ensures early detection of anemia, allowing for timely intervention with iron (Fe) supplementation. In healthcare centers, pregnant women typically receive 90 Fe tablets to prevent anemia. Studies have shown a significant correlation between Fe tablet supplementation and hemoglobin levels in third-trimester pregnant women, particularly among those aged 20–35 years (70%) ($p<0.05$) (Rizki et al., 2018)

Hemoglobin (Hb) is essential for transporting oxygen throughout the body. In cases of maternal anemia, reduced oxygen circulation can disrupt metabolic processes, which naturally increase during pregnancy (Yusniati, 2019). This study aims to assess hemoglobin levels in pregnant women at Puskesmas Purwokerto Timur II, Banyumas Regency.

Methods

Study Design

This study employed a descriptive observational approach with a cross-sectional design conducted between April and May 2022 at Puskesmas Purwokerto Timur II, Banyumas Regency. Ethical approval was obtained from the Health Research Ethics Commission of Muhammadiyah Purwokerto University (Approval Number: KEPK/UMP/36/IV/2021).

The study population comprised pregnant women registered as patients at Puskesmas Purwokerto Timur II, Banyumas Regency. A total of 20 pregnant women who met the inclusion and exclusion criteria were selected as study participants. The sample size was determined based on the number of pregnant women visiting the health center between March and June 2021, using a purposive sampling technique.

The inclusion criteria for this study were pregnant women in their first to third trimesters who attended antenatal check-ups at Puskesmas Purwokerto Timur II and provided written informed consent. Exclusion criteria included pregnant women who declined participation, those who withdrew during the study, and those diagnosed with eclampsia or blood disorders, as well as individuals with injuries that could interfere with the sampling process.

Equipment and Materials

The equipment utilized in this study included a Point of Care Testing (POCT) device, hemoglobin test strips, a lancet device, blood lancets, label paper, sterile cotton, tissues, face masks, and disposable gloves. The materials used consisted of capillary blood samples and 70% alcohol for disinfection.

Capillary Blood Collection Procedure

All necessary equipment is prepared on a clean surface. To minimize discomfort, gentle pressure is applied to the selected fingertip before disinfection with 70% alcohol, allowing it to dry completely. A sterile lancet is then used to puncture the fingertip swiftly, ensuring the incision is perpendicular to the fingerprint lines. The first drop of blood is wiped away using a dry cotton swab, while the subsequent drop is collected for testing (Priyana, 2017).

POCT Device Calibration Procedure

Insert the code chip into the POCT device to begin the calibration. Press and hold the power button for 3 seconds until a *beep* is heard, and the display shows **SET** on the LCD screen. Press the ▲ button to activate the quality control solution testing mode, at which point the LCD will display 'CTL.' Then, press the power button to proceed. (Nidianti et al., 2019)

Insert the test strip and verify the code number on the test strip container. Shake the control solution bottle gently and press it to release a drop of the solution. Discard the first drop and repeat until a clear drop is obtained. Apply the control solution drop to the blood zone of the test strip, ensuring it is absorbed.

Once the liquid is absorbed, the measurement begins. Be sure to securely close the control solution bottle after use. Press the ▲ button to display the measurement result on the screen. The control solution symbol will appear on the LCD. Press the power button to store the results in the device. If the results fall outside the acceptable range, repeat the calibration. Successful calibration is confirmed by comparing the results to the reference values listed on the test strip container.

Hemoglobin Test Procedure Using the Azidemet POCT Method

Prepare all necessary tools on the table. Match the chip code number with the code on the test strip bottle. Insert the test strip into the POCT device until a 'beep' sound is heard and confirm the code number on the strip bottle. Using a mini pipette, collect 7 µL of the blood sample. Gently press the mini pipette against the test strip to apply the blood, allowing it to be absorbed. The measurement result will be displayed within 5 seconds. (Nidianti et al., 2019)

Data Analysis

Hemoglobin levels in pregnant women at the Puskesmas Purwokerto Timur II were analyzed using a univariate test

Results and Discussion

According to Table 1, the majority of the pregnant women were aged 20-30 years, with 14 individuals (70%) having an average age of 29.90 ± 4.315 years. The youngest was 24 years old, while the oldest was 41 years old. Most of the participants were in the 1-12 week and 13-27 week gestational age groups, with 7 women (35%) in each group, resulting in a mean gestational age of 19.80 ± 10.837 weeks. The youngest gestational age was 4 weeks, and the oldest was 36 weeks. Regarding pregnancy history, the majority had their second pregnancy (9 women, 45%), had completed senior high school (9 women, 45%), and were housewives (15 women, 75%).

The majority of pregnant women had normal Hb levels, with 19 women (95%) showing a mean Hb of 12.820 ± 1.5558 g/dL. The lowest Hb level recorded was 8.9 mg/dL, and the highest was 14.9 g/dL. Regarding medical history, 19 women (95%) did not have a history of anemia, 17 women (85%) took blood-boosting tablets, and 18 women (90%) complied with their prescribed tablet regimen.

The mean Hb level for pregnant women in the first trimester was 13.929 ± 0.6047 g/dL, with the lowest Hb being 13.3 g/dL and the highest 14.9 g/dL. In the second trimester, the mean Hb level was 11.500 ± 1.7804 g/dL, with a minimum of 8.9 g/dL and a maximum of 14.7 g/dL. For the third trimester, the mean Hb level was 13.067 ± 0.8501 g/dL, with a minimum of 11.9 g/dL and a maximum of 13.9 g/dL

Table 1. The characteristics of the subject

No.	Characteristic	Frequency (n)	Percentages (%)	Mean ± SD	Median (Min-Max)
1	**Age (y.o)**				
	20-30	14	70,0		
	31-40	5	25,0	29,90 ± 4,315	29,50 (24-41)
	41-50	1	5,0		
2	**Gestational age (week)**				
	1-12	7	35,0		
	13-27	7	35,0	19,80 ± 10,837	20,50 (4-36)
	28-40	6	30,0		
3	**Pregnancy order**				
	1	6	30,0		
	2	9	45,0		
	3	4	20,0		
	6	1	5,0		
4	**Education**				
	Junior high school	5	25,0		
	Senior high school	9	45,0		
	University	6	30,0		
5	**Job**				
	Private Employee	4	20,0		
	Self-employed	1	5,0		
	Housewife	15	75,0		
6	**Hemoglobin levels (g/dL)**				
	Low	1	5,0	12,820±1,5558	13,350 (8,9-14,9)
	Normal	19	95,0		
7	**Hemoglobin levels per trimester (g/dL)**				
	1St trimester	7	35,0	13,929±0,6047	13,600 (13,3-14,9)
	2nd trimester	7	35,0	11,500± 1,7804	11,400 (8,9-14,7)
	3rd trimester	6	30,0	13,067±0,8501	13,250 (11,9-13,9)
8	**History of anemia**				
	Yes	1	5,0		
	No	19	95,0		
9	**Take blood-boosting tablets**				
	Yes	17	85,0		
	No	3	15,0		
10	**Compliance with blood supplement consumption**				
	Yes	18	90,0		
	No	2	10,0		

In this study, the majority of pregnant women were aged 20-30 years, comprising 14 respondents (70%). This suggests that the majority of women who undergo hemoglobin checks at Puskesmas Purwokerto Timur II are within the productive age range. These findings are consistent with a study by Baharutan et al. which reported that 80% of pregnant women were aged 20-35 years. Pregnant women under 20 years old are considered too young for pregnancy and childbirth, while those over 35 years old face higher risks during pregnancy and delivery

(Baharutan et al., 2016). This is further supported by Youssry et al. research was reported that age both under 30 and over 30 influences the severity of anemia in pregnant women (Youssry et al., 2018).

The age range of 20-35 years is considered optimal for pregnancy and childbirth because, at this age, the body's organs are fully developed and functioning properly, making it suitable for conception and delivery. Pregnant women under 20 years old face increased risks during childbirth, such as breech delivery, due to narrower pelvic dimensions, which can complicate the labor process. On the other hand, women over 35 may experience a decline in tissue regeneration, particularly in the endometrium, due to biological aging and associated health conditions that could lead to complications, including abnormal fetal positioning (Amini et al., 2018).

Pregnant women should avoid being in the "4T" conditions, which include being too young (<20 years), too frequently pregnant, too close to their previous birth (<3 years), or too old (>35 years). Adhering to these guidelines helps minimize the risks to both the mother and baby (K. Anggraini et al., 2018).

In this study, the majority of pregnant women were in the first trimester (1-12 weeks) and second trimester (13-27 weeks), each comprising 35% of respondents, while 30% were in the third trimester (28-40 weeks). These findings align with Baharutan et al. research showed a higher proportion of second-trimester respondents (60%) compared to third-trimester respondents (40%) at Puskesmas Bahu, Malalayang District, Manado City (Baharutan et al., 2016).

During the second trimester, a pregnant woman's need for iron increases due to a rise in red blood cell production, driven by the growing oxygen demands of the fetus. Hemoglobin levels tend to decrease during this period, typically by around 1 g/dL. In addition to iron supplementation, it is crucial for pregnant women to consume foods rich in iron to support their health (Tarwoto, 2013).

The demand for iron is highest during the third trimester of pregnancy, as the fetus stores iron for future use. Iron deficiency can lead to insufficient hemoglobin, which is essential for oxygen transport to both the fetus and the mother's cells (Nurhayati & Fikawati, 2016). Pregnant women in their third trimester are at 19 times higher risk of anemia ($p = 0.000$, OR = 19.95) (Sjahriani & Faridah, 2019).

In the first trimester, the iron requirement is lower due to the absence of menstruation and slower fetal growth. However, during the second and third trimesters, blood volume increases by up to 35%, which requires approximately 450 mg of iron to produce red blood cells that

deliver oxygen to the fetus. Additionally, pregnant women need an extra 300-350 mg of iron before delivery to account for blood loss. On average, pregnant women require about 40 mg of iron per day, which is double the amount needed by non-pregnant women (Susiloningtyas, 2012).

In this study, the majority of pregnant women had a high school education, with 9 participants (45%). This contrasts with a study by Desy & Darmawati, which found that most pregnant women in Aceh Besar Regency had a lower level of education, with 62 respondents (38.5%). The study also identified a significant relationship between education level and the incidence of anemia ($p<0.05$) (Desy & Darmawati, 2018).

The high prevalence of anemia among pregnant women may be attributed to a lack of knowledge about the consequences of hemoglobin deficiency. Additionally, the limited financial resources of these women can hinder their ability to access iron-rich foods and supplements necessary during pregnancy (Edison, 2019).

In this study, the majority of pregnant women were housewives, with 15 participants (75%). This contrasts with the findings of Isnaini et al. reported that the majority of pregnant women with anemia at Puskesmas Sanggeng were non-working, with 96 participants (85.71%). No significant relationship was found between employment status and the incidence of anemia among pregnant women (Isnaini et al., 2021). Both working and non-working pregnant women can be affected by varying degrees of anemia, including mild and severe forms ($p<0.05$) (Youssry et al., 2018).

In this study, the majority of pregnant women had normal hemoglobin levels, with 19 participants (95%) showing normal Hb levels. Only one respondent (5%) had low Hb levels and was in the second trimester of pregnancy. The average Hb levels across the first, second, and third trimesters remained within normal ranges. These findings are consistent with research by Baharutan et al., which reported that 16 out of 30 pregnant women (88.89%) in their second trimester had normal Hb levels (>10.5 g/dL), while 2 (11.11%) experienced anemia (Baharutan et al., 2016). Similarly, 9 (75%) of third-trimester pregnant women had normal Hb levels (>11 g/dL), while 3 (25%) had anemia. Anggraini's research also supports these results, showing that 24 (70.6%) pregnant women had normal hemoglobin levels, while 10 (29.4%) experienced anemia (D. D. Anggraini, 2018). In contrast, a study by Syantih et al. found a higher incidence of anemia, with 63 pregnant women (54.8%) having anemia at Puskesmas Kuta Selatan, compared to 52 (45.2%) without anemia (Syantih et al., 2021).

The mean of hemoglobin levels in the 1st trimester in this study was 13,929±0,6047 g/dL, the 2nd trimester was 11,500±1,7804 g/dL, and the 3rd trimester was 13,067±0,8501 g/dL, slightly different from Nurhajimah et al. reported for the mean of hemoglobin levels in the 1st trimester was 11,7442 ± 0,67517 g/dL, the 2nd trimester was 11,0269 ± 0,55699 g/dL, and the 3rd trimester was 10,2846 ± 0,58222 g/dL (Nurhajimah et al., 2024)

During pregnancy, low hemoglobin levels are commonly associated with physiological hemodilution, a normal process that begins around the 10th week and peaks between 32 and 36 weeks of gestation. Hemodilution reduces blood viscosity, which can lower cardiac workload, decrease peripheral resistance to help prevent hypertension, and minimize iron loss during delivery. This process contributes to the gradual decline in hemoglobin levels observed across all three trimesters (Hudono, 2013).

Some studies suggest that low hemoglobin levels in pregnant women can stimulate corticotropin synthesis, leading to the release of hormones that induce pregnancy and fetal stress. This can increase the risk of hypertension, eclampsia, and premature rupture of membranes. On the other hand, high hemoglobin levels can lead to increased blood viscosity, which may impair optimal oxygen and nutrient supply to the placenta and fetus. Additionally, inadequate plasma volume expansion can contribute to complications such as hypertension, preeclampsia, and diabetes in pregnant women (Jung et al., 2019).

The majority of pregnant women in this study took blood supplement tablets, with 17 respondents (85%) reporting regular consumption. Furthermore, 18 respondents (90%) were compliant with their prescribed blood supplement regimen. These findings align with Anggraini's study which found that 52.9% of pregnant women at the South Region Health Centre in Kediri City were highly compliant with taking iron supplements, while 17.6% were moderately compliant, and 29.4% were non-compliant (D. D. Anggraini, 2018).

Adherence to iron (Fe) supplementation plays a crucial role in maintaining optimal haemoglobin (Hb) levels during pregnancy. This is because the physiological expansion of plasma volume exceeds the increase in haemoglobin mass and red blood cell volume, increasing the body's demand for iron. Sufficient iron intake is essential for effective haemoglobin synthesis, as iron deficiency leads to the production of smaller red blood cells with reduced haemoglobin content, resulting in anaemia. Iron also supports oxygen transport and is a vital component of key respiratory

enzymes, including cytochrome oxidase, catalase, and peroxidase (Handayani, 2012).

Daily iron requirements vary depending on physiological conditions such as menstruation, pregnancy, lactation, and growth. During pregnancy and lactation, iron needs increase by approximately 3.0 mg per day. In the second and third trimesters, iron requirements rise to about 5-6 mg per day, leading to a total iron demand of around 1000 mg throughout pregnancy (Kurniati, 2020).

Abnormal hemoglobin (Hb) levels can manifest through symptoms such as fatigue, pale skin, dizziness, fainting, shortness of breath, swelling in the hands and feet, and excessive sweating. Several factors contribute to abnormal Hb levels, including excessive physical activity, dehydration, inadequate nutritional intake, bleeding, infections, and the use of certain medications. To maintain optimal Hb levels, pregnant women across all trimesters are advised to limit strenuous physical activity, stay well-hydrated, and consume a nutrient-rich diet comprising vegetables, fruits, fish, eggs, and nuts (Walyani, 2018).

A study conducted on 367 pregnant women in Southwest Ethiopia found that factors such as meal frequency, inter-pregnancy intervals, upper arm circumference, fruit and vegetable consumption, coffee intake, and a history of infant mortality were associated with haemoglobin (Hb) levels in pregnant women (Kuma et al., 2021). Additionally, factors including primigravida and multigravida parity, mode of delivery (caesarean or vaginal), low birth weight (LBW), chorioamnionitis-related wound infections, preterm birth, neonatal birth weight, and postpartum bleeding were linked to both mild and severe anaemia in pregnant women. The primary cause of anaemia during pregnancy is iron deficiency (92.8%), followed by thalassemia (0.5%), sickle cell anaemia (2.6%), and other causes (4%) (Youssry et al., 2018).

To accurately diagnose anemia caused by iron deficiency in pregnant women, a comprehensive hematological assessment is required in addition to measuring hemoglobin (Hb) levels. This includes evaluating hematocrit levels, reticulocyte count, and Reticulocyte Hemoglobin Content (CHr), as well as erythrocyte indices such as mean corpuscular volume (MCV), mean cell hemoglobin (MCH), and mean cell hemoglobin concentration (MCHC). Furthermore, biochemical tests should be conducted, including assessments of serum ferritin, Total Iron-Binding Capacity (TIBC), zinc protoporphyrin (ZPP), serum iron levels, and transferrin saturation (Kurniati, 2020).

Conclusion

The majority of respondents (95%) had haemoglobin levels within the normal range. The mean Hb level for pregnant women in the first trimester was 13.929 ± 0.6047 mg/dL, while in the second trimester, it averaged 11.500 ± 1.7804 mg/dL. It is necessary to monitor the hemoglobin level of pregnant women periodically

To ensure a comprehensive diagnosis of anaemia in pregnant women, additional haematological assessments are recommended, including haematocrit levels, reticulocyte count, Reticulocyte Haemoglobin Content (CHr), and erythrocyte indices such as mean corpuscular volume (MCV), mean cell haemoglobin (MCH), and mean cell haemoglobin concentration (MCHC).

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Mapping Intestinal Worm Infections and Their Relationship with Nutritional Status and Personal Hygine of School Age Children in Wori District, North Minahasa Regency

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ABSTRACT

Introduction: Parasitic infections cause health problems, including diarrhea, abdominal pain, malnutrition, general malaise and weakness, as well as impaired physical growth and development. These parasitic infections are generally higher in countries with high Factors that influence public health problems include weak economic conditions, limited access to sanitation and clean water, high rates of malnutrition among the population, population density, community habits that do not meet hygiene standards, low levels of education, and mothers' minimal insight into health.
Objective: This study aims to identify the distribution of intestinal worm infections in school-age children in Wori District, North Minahasa Regency, and to analyze the relationship between these infections and children's nutritional status and the implementation of clean and healthy living behaviors (PHBS).
Methods: A quantitative approach was used, integrating statistical analysis and distribution mapping. The study took place from January 2023 to May 2024, involving 14 elementary schools and 309 students selected via random sampling. Statistical analysis assessed the relationship between worm infections, nutritional status, and PHBS indicators.
Results: The study results indicated that respondents were infected with Ascaris lumbricoides and hookworm. Statistical tests showed a statistically significant association between infection incidence and handwashing habits and twice-daily bathing frequency, with a p-value <0.005.
Conclusions: Based on research findings, intestinal worm infections in elementary school children were identified in all village areas in Wori District, with the exception of Lansa Village which did not show any cases of infection. No significant association was found between intestinal worm infections and children's nutritional status. However, there was a statistically significant association between infection incidence and handwashing and bathing twice daily.

Introduction

Intestinal parasitic infections are among the most common infectious diseases with an estimated 3.5 billion cases annually. These infections are responsible for more than 450 million health problems, including symptoms such as diarrhea, abdominal pain, malnutrition, fatigue,

general weakness, and stunted growth and physical development (Octavia, Ericka., Sihombing, R, 2020). Approximately 24% of the world's population is estimated to be infected with soil-transmitted helminths. These infections commonly occur in areas with high poverty rates and limited access to adequate sanitation facilities (Soil-Transmitted Helminth Infections, 2023). Children are particularly vulnerable to these infections and are at high risk of recurrent infections (Kantzanou et al., 2021).

Parasites are generally divided into two main categories: protozoa and helminths (worms). Some of the most common types of worms that cause infections include Ascaris lumbricoides, hookworms such as Necator americanus and Ancylostoma duodenale, and Trichuris trichiura. These three species are categorized as soil-transmitted helminths (STH) (Soil-Transmitted Helminth Infections, 2023). Asia has a high prevalence of parasitic infections. These infections commonly occur in children, particularly in developing countries where environments are conducive to parasite survival and cycles. Countries with hot climates and high humidity tend to be ideal locations for parasite spread (Sari et al., 2021). Indonesia is one of the countries that shows a significant level of intestinal worm infectionSeveral studies on intestinal worm infections have been conducted in several regions in Indonesia, demonstrating a high prevalence of several types of parasites. Among these is Ascaris lumbricoides, with infection rates ranging from 40–60% in the general population and 60–80% in children aged 5 to 10 years. Furthermore, the prevalence of Trichuris trichiura is reported to be between 30–90%, while hookworm infections are recorded at 30–40%.
(Permenkes, 2017), *Blastocystis hominis*, *Entamoeba histolytica*, and *Giardia lamblia* (Wahdini et al., 2018). This parasitic infection is generally higher in countries with high Public health problems are influenced by various factors, such as high levels of poverty, limited sanitation facilities and access to clean water, high prevalence of malnutrition among the population, excessive population density, low public hygiene practices, and lack of formal education and health knowledge among mothers. (Sari et al., 2021). Currently, all of these factors still exist in Indonesia, so intestinal parasite infections are still high.

Malnutrition is caused by a lack of energy and nutritional intake in a person's diet. There is a strong link between nutritional status and intestinal worm infections. These infections remain a major factor in increasing morbidity and mortality in children, primarily due to their contribution to malnutrition. To date, intestinal parasitic infections remain a

major global public health challenge, particularly in developing countries, due to their significant impact on malnutrition (Sari et al., 2021). According to WHO in 2018, more than two-thirds of children under five who experience wasting live in Asia and more than a quarter live in Africa (UNICEF et al., 2019). Indonesia is among the countries with a relatively high prevalence of stunting and wasting globally. with a stunting rate of more than 30% and a wasting prevalence (Unicef, 2023). of 10–15% in children under five (Reinhardt & Fanzo, 2014). Malnutrition increases the chance of infection and its severity also slows recovery (Unicef, 2023). There is a close link between malnutrition and the immune system. Malnutrition can cause serious impairments in the development and function of the immune system, and conversely, immune system dysfunction can also increase a child's susceptibility to parasitic infections. Conversely, repeated intestinal infections can potentially damage the epithelial structure of the digestive tract, thus inhibiting optimal nutrient absorption. Thus, malnutrition and infection influence each other in a reciprocal relationship (Simon et al., 2015). By looking at the problems that have been identified previously, this study was conducted to determine the pattern of the spread of intestinal worm infections, examine the relationship between these infections and children's nutritional status, and assess the implementation of clean and healthy living behaviors (PHBS) in school-age children in Wori District, North Minahasa Regency.

Methods

The type of research is quantitative research using statistical analysis methods and making distribution maps. When the research began in January 2023 to May 2024, five schools were sampled in 2023 and nine schools were sampled in 2024. The study sample was taken from the Wori District, while infection testing was conducted at the Parasitology Laboratory, Medical Laboratory Technology Department, Manado Health Polytechnic, under the auspices of the Ministry of Health. The variables examined in this study included intestinal worm infections, nutritional status, and the implementation of clean and healthy living behaviors (PHBS) in school-age children. The study population included all elementary school students in the Wori District. The sample taken using random sampling technique amounted to 309 students. The samples collected met the criteria for examination.

Materials used include stool samples, 2% eosin solution, saturated NaCl, glycerin malachite green solution, cellophane tape measuring 2.5 cm wide, and aqaudest. The tools used are a microscope, slide slide, new clean glass deck, new clean sample pot,

clean stick, disposable pipette, mask, handscoon. Samples were stored at room temperature and examined immediately, if there was a delay, the samples were preserved in 10% formalin solution. Determination of the intensity of helminth infection is based on the recommended formula. Sample examination uses several methods, namely the native method, floating method, Kato Katz method, Baerman test method and Harada Mori method. Statistical analysis was carried out To examine the relationship between soil-transmitted helminth (STH) infections, nutritional status, and the adoption of clean and healthy lifestyles in school children.

This section explains the basis for selecting the specific approaches, methods, procedures, and techniques used in identifying, selecting, and analyzing relevant data to understand the research problem. This explanation aims to enable readers to critically evaluate the validity and reliability of the research process.

Results and Discussion

The samples collected from 309 respondents were samples that met the requirements, namely that the respondents had not taken worm medicine in the last three months, the samples had not been mixed with water, urine or soil.

Table 1. Respondent characteristics

Respondents		Freq (n=309)	Percentage (%)
Age (years)	6	13	4.2
	7	39	12.7
	8	47	15.2
	9	64	20.8
	10	40	12.9
	11	59	19
	12	36	11.7
	13	11	3.5
Gender	Male	144	46.7
	Women	165	53.3
Parent's Profecy	Farmer	164	53
	Fisherman	9	3
	Handyman	26	8.4
	Civil Servant	20	6.4
	Teacher	7	2.2
	Entrepreneur	9	3
	Housewife	68	22
	Soldier	4	1.2
	Driver	2	0.8

Table 1 This data presentation illustrates the distribution of respondent characteristics by age group. Alternatively, respondent characteristics can also be reviewed based on gender and parental occupation. Children are a group that is vulnerable to intestinal worm infections because they are not yet able to implement good clean living habits (Bedah & Syafitri, 2019). The risk level of intestinal worm infection in boys does not show any significant difference compared to girls. depending on the implementation of clean living behavior and other factors that are at risk of intestinal worm infection. Table 1 shows that the majority of respondents' parents work as farmers; This needs to be known because parents' work can be a risk factor for transmitting worm infections to children because parents play a role in providing children's basic needs such as food which is closely related to the transmission cycle of worm infections (Justine et al., 2024).

Table 2. Laboratory Result

Examination Results (species)	Natif		Flotation		Kato-Katz		Baermann		Harada Mori	
	Freq (n=309)	Percentage (%)	Freq (n=309)	Percentage (%)	Freq (n=309)	Percentage (%)	Freq (n=309)	Percentage (%)	Freq (n=309)	Percentage (%)
A.lumbricoides	18	5.1	7	2.2	2	0.8	2	0.8	0	0
Hookworm	0	0	2	0.7	0	0	1	0.3	0	0
Negative	291	94.1	300	97.1	307	99.3	306	99	309	100

Table 2 shows the results of various examination methods, namely the native method identified 5.1% of respondents as having *Ascaris lumbricoides* worm infection. Flotation tests showed that 2.2% of respondents were infected with Ascaris lumbricoides and 0.7% with hookworm. Meanwhile, the Kato-Katz method identified Ascaris lumbricoides infection in 0.8% of respondents. Furthermore, the Baermann test found the prevalence of Ascaris lumbricoides at 0.8% and other worm infections at 0.3%.

The native method is an examination that provides results with the highest positive presentation, showing the validity of the native method as the gold standard for examining intestinal worm infections. Almost all examination methods found *Ascaris lumbricoides* worm eggs and Hookworm worm eggs were found in the sedimentation method examination and found the larval stage in the Baermann examination. *Ascaris lumbricoides* infection is related to the implementation of clean and healthy living behavior where in general respondents have not implemented

clean and healthy living behavior. Hookworm infection was found only by the Baermann sedimentation and examination method; This is because the surface of the Hookworm worm eggs is thin so they are easier to identify by examining their deposition and larvae in the Baermann examination. The examination that is currently being developed is an examination with the help of artificial intelligence (Cure-Bolt et al., 2024). This inspection method is based on image-based artificial intelligence; This method has a low sensitivity but a specificity of more than 90% (Lundin et al., 2024). This method has the principle of producing images on fecal samples stored on the internet cloud but this method has lower sensitivity than the Kato Katz method (Moser et al., 2018).

Intestinal worm infections contribute to malnutrition, anemia, low birth weight babies, impaired growth and decreased academic achievement. *Ascaris lumbricoides* infections are more common in school-aged children than adults, while hookworm infections are more common in adults (Avokpaho et al., 2021). *Ascaris lumbricoides* infection causes impaired absorption of nutrients so that sufferers have the potential to experience malabsorption and loss of nutrients (Fabiana Meijon Fadul, 2019), Meanwhile, Hookworm infection can cause anemia because the Hookworm worm in the intestine will attach a pair of teeth or cutting plates to the surface of the intestine so that sufferers can lose blood. Apart from that, the Hookworm worm eats erythrocytes to survive. The results of the study show that there is a relationship between parasitic infections and the incidence of anemia in school-aged children (Deschutter et al., 2024).

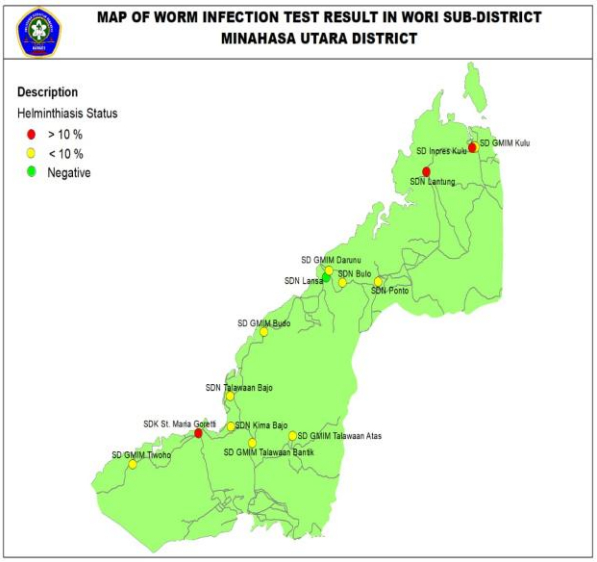

Figure 1. Mapping of Intensity of STH Infection

Figure 1 presents data on the number of cases of worm infections found in children at the elementary school level. This needs to be used as material for evaluating prevention efforts that have been implemented by the local government. The routine program of taking worm medicine twice a year needs special attention because even though it is implemented, if it is not balanced with awareness of implementing clean living habits and adequate sanitation then efforts to eliminate worms will not be successful.

Table 3. Relation of Nutrition status and Helminths Infection

Nutrition status	Helminths Infection				Total		P Value
	Positive		Negative				
	n	%	n	%	n	%	
Very Skinny	3	0.9	4	1.2	7	2.3	0,025
Thin	2	0.6	20	6.4	22	7.1	
Normal	23	7.4	243	78.6	266	86	
Fat	0	0	12	3.9	12	3.9	
Risk of Obesity	0	0	2	0.7	2	0.7	

Table 3 This presentation provides information on the results of a statistical analysis conducted to examine Correlation between respondents' nutritional status and the incidence of intestinal worm infections. Based on the results, no significant association was found between nutritional status and the incidence of intestinal worm infections. The results show that there is no relationship between nutritional status and the incidence of intestinal worm infections. The same results were shown by research conducted by Risa H *et all* (2017) that there was no relationship between nutritional status and infection but there was a relationship between respondent's implementation of clean behavior and the incidence of infection(Risa et al., 2017). This is also reinforced by the results of other research which shows that even though respondents live in slums, if they adopt clean living habits they can reduce the risk of worm infections (Octavia, Ericka., Sihombing, R, 2020).

Table 4. The Relationship between Respondents' Clean and Healthy Living Behavior (PHBS) and the Prevalence of Intestinal Worm Infections

Behavior		Worm Infection				Total	P Value
		Positive		Negative			
		n	%	n	%		
Hand Washing Habit	Yes	20	6,5	240	77,6	260	0,000
	No	12	3,9	37	12	49	
	Total	32	10,4	277	89,6	309	
Shower twice a day	Yes	26	8,4	248	80,3	274	0,000
	No	6	1,9	29	9,4	35	
	Total	32	10,3	277	89,7	309	
Finger Sucking Habit	Yes	13	4,2	83	26,9	96	0,271
	No	19	6,1	194	62,8	213	
	Total	32	10,3	277	89,7	309	
Eat Fallen Food	Yes	6	1,9	46	14,9	52	0,759
	No	26	8,9	231	74,8	257	

	Total	32	10,3	277	89,7	309	
The habit of playing soil	Yes	22	7,1	147	49,6	175	0,092
	No	10	3,2	124	40,1	134	
	Total	32	10,3	277	89,7	309	
Use of Footwear	Yes	18	5,8	147	47,6	165	0,733
	No	14	4,5	130	42,1	144	
	Total	32	10,3	277	89,7	309	
Nail-Biting Habit	Yes	14	4,5	77	24,9	91	0,061
	No	18	5,8	200	64,8	218	
	Total	32	10,3	277	89,7	309	
Availability of toilets at home	Yes	31	10	274	88,7	305	0,333
	No	1	0,3	3	1	4	
	Total	32	10,3	277	89,7	309	
Defecate in the toilet	Yes	31	10	275	89	306	0,189
	No	1	0,3	2	0,7	3	
	Total	32	10,3	277	89,7	309	
Take worm medicine every 6 months	Yes	25	8,1	241	78	266	0,169
	No	7	2,3	36	11,6	43	
	Total	32	10,4	277	89,6	309	
Eat raw/uncooked food	Yes	14	4,5	105	34	119	0,520
	No	18	5,8	172	55,7	190	
	Total	32	10,3	277	89,7	309	
Eating Unwashed Food	Yes	13	4,2	105	34	118	0,764
	No	19	6,1	172	55,7	191	
	Total	32	10,3	277	89,7	309	

Table 4 shows the implementation of clean and healthy living behavior with the incidence of intestinal worm infections. The table shows that the habit of washing hands and bathing twice a day is related to the incidence of intestinal worm infections. Apart from implementing clean and healthy living behavior (PHBS), the environmental sanitation conditions where respondents live are also related to the incidence of worm infections. The sanitation referred to includes the type of floor, availability of clean water, ownership of rubbish bins, and waste water disposal facilities (Mahmudah, 2017). This is in accordance with other research which shows a relationship between the incidence of infection and the habit of washing hands, cutting nails, consuming raw food, type of floor in the house and owning a toilet (Sidabutar, 2020). Other research shows the opposite result that the incidence of worm infections is not related to sanitation even though the highest incidence of infection is 22% (Oswald et al., 2017).

Conclusion

Based on the research results, it can be concluded that intestinal worm infections are still a health problem found among

elementary school children in school children are spread across all villages in Wori District except Lansa Village, there is no relationship between the incidence of worm infections and nutritional status, and there is a relationship between the incidence of infection and the habit of washing hands and bathing twice a day.

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Conflict of Interest

No conflict of interest in this study

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The Effect of Age and Gender on the Pain Scale of LBP Patients

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ABSTRACT

Introduction: Low back pain (LBP) is a prevalent condition affecting people across various age groups and genders. Age-related degeneration and gender-specific hormonal factors are believed to influence pain perception in LBP patients.
Objective: This study aims to examine the influence of age and gender on pain intensity in patients with LBP.
Methods: A cross-sectional observational study was conducted on 47 patients diagnosed with LBP at RSI Jemursari Surabaya. Pain was assessed using the Numeric Rating Scale (NRS). Respondents were grouped by age (20–30, 31–40, 41–50, 51–60, >60 years) and gender (male, female). Pearson correlation and independent t-tests were used for statistical analysis.
Results: Among the respondents, 89.4% were female, with the largest age group being 41–50 years (42.6%). There was a significant positive correlation between age and pain scale ($r = 0.42$, $p = 0.003$). Females reported significantly higher pain scores compared to males ($p = 0.018$).
Conclusions: Age and gender are significantly associated with pain severity in LBP patients. Older individuals and females tend to report more intense pain. These findings highlight the importance of personalized pain management strategies considering demographic factors.

Introduction

Low back pain (LBP) has consistently ranked as one of the leading causes of disability worldwide over the past three decades, resulting in substantial healthcare costs and lost productivity (Hayden et al., 2021). It is typically characterized as discomfort localized in the lower back region, from the lower ribs to the gluteal fold, and may radiate to the lower extremities (Chiodo et al., 2020). Large population-based studies also confirm that the prevalence of chronic pain increases with age and is consistently higher among women, possibly due to both biological and psychosocial factors (Martínez & Sánchez, 2023)

It is estimated that approximately 80% of the global population experiences LBP at some point in their lives (Sahara & Pristya,

2020). In a large-scale national study conducted in the United States, the prevalence of chronic low back pain (cLBP) was found to be over 13%, with higher rates among older adults and women, reinforcing the global burden of this condition (Shmagel, Foley, & Ibrahim, 2016). Numerous factors influence the intensity and perception of pain, with age and gender identified as significant contributors. Aging is commonly associated with spinal degeneration, which may exacerbate pain severity, while hormonal and psychosocial differences contribute to gender-related variations in pain perception (Mu et al., 2020; Fonseca-Rodrigues et al., 2022).

Low back pain (LBP) is not only the leading cause of disability globally but also imposes a substantial economic burden. According to the Global Burden of Disease study, LBP accounts for over 60 million years lived with disability (YLDs) worldwide, leading to productivity loss and increased healthcare expenditures (Wu et al., 2020). In Indonesia, the economic impact is particularly evident in informal workers and labor-intensive sectors, where even short-term disability from LBP can significantly disrupt household income. However, data on national cost estimations remain scarce, underscoring the need for more localized studies that combine epidemiological and economic analyses.

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variations in pain perception (Mu et al., 2020; Fonseca-Rodrigues et al., 2022).

Beyond biological explanations, the biopsychosocial model offers a comprehensive framework for understanding LBP. This model considers how psychological variables—such as mood, catastrophizing, and coping styles—along with social factors, like family support and work environment, interact with biological components to shape pain experience (Gatchel et al., 2007; Kamper et al., 2015). Notably, women are more likely to experience depression and anxiety, which may heighten their sensitivity to pain and influence pain behaviors (Mayer et al., 2022).

Despite abundant global studies, research focusing specifically on the Indonesian population remains limited. This study aims to fill that gap by evaluating the relationship between age, gender, and pain intensity in patients with LBP at RSI Jemursari Surabaya. Through this investigation, we hope to provide evidence that can inform tailored pain management strategies sensitive to demographic characteristics.

Previous research also indicates a strong association between anxiety levels and pain intensity in LBP patients (Amsori et al., 2024). However, few studies have comprehensively analyzed the direct influence of age and gender on pain intensity in the Indonesian population. This study aims to fill that gap by evaluating the relationship between these demographic factors and pain severity in LBP patients at RSI Jemursari Surabaya.

In Indonesia, low back pain (LBP) remains one of the most commonly encountered musculoskeletal conditions in primary healthcare settings, particularly among working-age adults and women. Data from national health reports indicate that musculoskeletal disorders rank among the top ten contributors to years lived with disability (YLD) in individuals aged 30–59 years (Ministry of Health Republic of Indonesia, 2018). However, despite this high prevalence, challenges persist in the clinical management of LBP at the primary care level. Many general practitioners lack structured training in pain assessment and evidence-based interventions, leading to variability in diagnosis and treatment (Yusuf, Kurniawan, & Widajanti, 2022). Furthermore, sociocultural norms and economic constraints may influence pain perception, care-seeking behavior, and adherence to therapy. These contextual factors emphasize the need for demographic-specific studies that can inform effective and equitable LBP management strategies tailored to Indonesia’s healthcare landscape.

A recent study highlighted that age and BMI were significantly associated with

both the duration and severity of LBP, although no meaningful difference was observed between genders in terms of pain intensity (Yilmaz, Demirkol, & Aydin, 2024). Central obesity, as measured by a body shape index (ABSI), was found to be associated with an increased risk of LBP, particularly in men and older adults, highlighting the importance of body composition beyond simple BMI (Xie et al., 2025).

Methods

This study employed an analytical observational design with a cross-sectional approach. The research was conducted at the Outpatient Clinic of RSI Jemursari Surabaya between September and November 2024. Ethical clearance was obtained from the Health Research Ethics Committee of Universitas Nahdlatul Ulama Surabaya (No. 015/EC/RSIJ/X/2024).

A total of 47 patients diagnosed with low back pain (LBP) were recruited using consecutive sampling. Inclusion criteria included patients aged over 20 years, diagnosed clinically with nonspecific LBP, and capable of providing informed consent. Exclusion criteria included individuals with neurological deficits, spinal fractures, malignancies, pregnancy, or severe cognitive impairment. All participants signed written informed consent prior to data collection.

Pain intensity was measured using the Numeric Rating Scale (NRS), a validated tool where respondents rated their pain on a scale from 0 (no pain) to 10 (worst imaginable pain). Sociodemographic data, including age and gender, were also recorded. Age was grouped into five categories: 20–30 years, 31–40 years, 41–50 years, 51–60 years, and over 60 years. Gender was classified as male and female.

Data were analyzed using SPSS version 25.0. Pearson correlation was used to assess the relationship between age and pain intensity. An independent t-test was applied to determine the difference in mean NRS scores between genders. A p-value < 0.05 was considered statistically significant.

The Numeric Rating Scale (NRS) was selected due to its high validity and ease of use across diverse patient populations. Previous studies have shown that the NRS has strong concurrent validity with other pain assessment tools and is sensitive to changes in pain intensity over time (Ferreira-Valente et al., 2011). Its simplicity allows patients of varying educational backgrounds to report pain on a scale from 0 (no pain) to 10 (worst possible pain), making it particularly suitable for clinical settings in Indonesia. To minimize inter-rater variability, all pain assessments were conducted by the same trained evaluator using a standardized script.

Results and Discussion

Out of 47 respondents diagnosed with low back pain (LBP), the majority were female (89.4%) and fell within the 41–50 year age group (42.6%). The mean pain intensity score based on the Numeric Rating Scale (NRS) was higher among older patients and females.

Out of 47 respondents diagnosed with low back pain (LBP), the majority were female (89.4%) and fell within the 41–50 year age group (42.6%). The mean pain intensity score based on the Numeric Rating Scale (NRS) was higher among older patients and females.

Statistical analysis using Pearson correlation revealed a significant positive correlation between age and pain intensity ($r = 0.42$, $p = 0.003$), indicating that older individuals tended to report higher pain levels. Furthermore, the independent t-test showed a significant difference in pain scores between genders ($p = 0.018$), with females reporting greater pain intensity compared to males.

These results reinforce prior findings that aging is strongly linked to spinal structural degeneration, including decreased disc hydration, narrowing of intervertebral spaces, and facet joint osteoarthritis, all of which contribute to increased pain (Balagué et al., 2012). In addition, decreased pain tolerance and central sensitization have been documented in older adults, which may further explain their elevated pain perception (Lautenbacher et al., 2017).

The observed gender differences are consistent with literature showing that women typically report higher pain sensitivity and lower pain thresholds than men (Bartley & Fillingim, 2013). Hormonal influences, particularly estrogen, may play a modulatory role in nociceptive transmission, explaining the higher sensitivity observed among female patients (Mogil, 2020). Social and psychological constructs, such as willingness to report pain, anxiety levels, and coping strategies, may also contribute to gender-based disparities (Riley et al., 2002; Mayer et al., 2022).

The psychological component is particularly relevant in chronic pain syndromes. As noted by Amsori et al. (2024), anxiety is significantly associated with pain intensity in LBP, particularly among women. This supports the biopsychosocial model of pain, emphasizing the integration of psychological well-being into pain management approaches.

Interestingly, not all studies support the same conclusions. For example, Kowalski et al. (2022) reported no significant association between age or gender and pain severity among patients undergoing conservative rehabilitation for discopathy,

suggesting that therapeutic context or intervention stage may mediate these relationships. Additionally, cultural differences in pain expression and treatment-seeking behavior may also influence findings across populations (Tsang et al., 2008).

In this study, the large proportion of female participants may have amplified the gender–pain relationship; however, it also reflects the higher prevalence of LBP among women in the general population. While age was significantly correlated with pain, future studies with larger and more balanced samples are warranted to further validate these findings and account for potential confounders such as occupation, physical activity level, and comorbidities.

From a clinical standpoint, these findings support the need for personalized pain management strategies. For older adults, interventions that include posture correction, physical therapy, and core muscle strengthening may be emphasized. For female patients, a holistic approach addressing psychological stressors and hormonal influences may enhance outcomes. Education on pain coping mechanisms and lifestyle modification could also be tailored based on demographic risk profiles.

Comparative findings across Asian countries reflect similar trends in the influence of demographic factors on LBP. Sedentary lifestyles, often compounded by age-related musculoskeletal changes and limited access to health education, have been consistently linked to greater pain severity and chronicity (Chen et al., 2009). In countries with limited resources, such as Indonesia, older adults and women are particularly vulnerable due to barriers in accessing appropriate care and ergonomic infrastructure.

Within the Indonesian healthcare context, primary care physicians play a pivotal role in addressing musculoskeletal pain. However, challenges persist related to diagnostic capacity and adherence to pain management protocols. Yusuf et al. (2022) emphasized that variations in physician training and awareness significantly affect how LBP is treated at the primary care level. To enhance outcomes, system-wide integration of standardized assessment tools and age- and gender-sensitive treatment guidelines is essential.

From a public health perspective, understanding the influence of age and gender on LBP is essential for designing effective prevention programs. Workplace ergonomics, early musculoskeletal screenings, and gender-tailored health education should be prioritized by primary healthcare services. Moreover, integrating pain management into national non-communicable disease (NCD) strategies

could help mitigate the burden of chronic LBP across aging populations

Finally, these results highlight the importance of early screening and targeted prevention for populations at risk—especially aging women. By acknowledging the demographic dimensions of pain, healthcare providers can offer more empathetic, effective, and evidence-based treatment protocols.

Furthermore, there is growing evidence supporting community-level approaches for musculoskeletal care. Hoy et al. (2010) highlighted that empowering local healthcare workers with training in pain screening, lifestyle counseling, and physical rehabilitation is effective in reducing the chronicity of LBP, especially in underserved populations. In Indonesia, such approaches can be integrated into community health centers (Puskesmas), leveraging existing structures for broader outreach and continuity of care.

Comparable findings have been observed in other low- and middle-income countries. In Brazil, a national population-based study found that 39% of adults experienced chronic pain, with a higher prevalence among women and older adults. This disparity was attributed to hormonal changes, musculoskeletal degeneration, and sociocultural barriers to accessing care (de Souza et al., 2017). Similarly, in Northern India, a community-based study highlighted the significant burden of low back pain, both in terms of decreased quality of life and economic loss, particularly among elderly individuals engaged in manual labor (Sharma et al., 2020). These international findings align with the present study, reinforcing the influence of age and gender in shaping LBP experiences.

For Indonesia, the integration of low back pain prevention and management into existing community health systems—such as Puskesmas and Posyandu—offers a promising solution. Community health workers can be empowered to deliver early screening, ergonomic education, and non-pharmacological interventions tailored to at-risk groups. Embedding musculoskeletal care into national non-communicable disease (NCD) strategies would ensure sustainability and improve outcomes for populations most affected by LBP.

Limitations & Future Directions

This study has several limitations that should be acknowledged. First, the relatively small sample size (n = 47) may reduce the statistical power and limit the generalizability of the findings. The predominance of female participants (89.4%) also introduces a gender imbalance that could have influenced the observed outcomes. Although the gender disparity mirrors clinical trends in LBP care, a more balanced sample would provide more

nuanced insights into gender-specific pain patterns.

Second, the study was conducted at a single institution using a cross-sectional design, which restricts the ability to draw causal inferences. Longitudinal studies with larger, multicenter samples are recommended to better understand how age and gender influence pain trajectories over time.

Additionally, psychosocial variables such as anxiety, depression, occupational strain, and cultural factors were not measured, even though prior studies have highlighted their importance in shaping pain perception (Gatchel et al., 2007; Fonseca-Rodrigues et al., 2022). Future research should incorporate these multidimensional factors to improve the comprehensiveness of LBP assessments.

In terms of clinical practice, further investigation is needed to explore the effectiveness of community-based interventions, digital self-management tools, and integrated care models tailored to demographic characteristics. These strategies could contribute to more equitable and patient-centered management of LBP in Indonesia and other low-resource settings.

Conclusion

This study concludes that both age and gender significantly influence pain intensity in patients with low back pain (LBP). Older adults and female patients tend to report higher levels of pain, which may be attributed to biological degeneration, hormonal influences, and psychological vulnerability. These findings emphasize the relevance of demographic profiling in designing patient-centered interventions.

Clinicians should consider integrating age- and gender-sensitive approaches in LBP management, such as tailored physical rehabilitation programs, psychological support, and pain education. Recognizing these demographic patterns not only aids in early identification of high-risk groups but also enhances adherence to therapy and long-term outcomes. Furthermore, these results reinforce current guidelines that recommend biopsychosocial, non-pharmacologic strategies as a first-line approach to LBP.

Future research should focus on larger samples and explore additional variables such as occupation, obesity, physical activity level, and mental health status. Such efforts are essential to build comprehensive care pathways that are culturally appropriate and demographically responsive.

These findings call for the incorporation of musculoskeletal health into national health agendas, especially within primary and community-based care systems. Policies that support training of primary

care staff, improve access to pain assessment tools, and promote early screening programs can help reduce the burden of LBP, particularly among vulnerable populations such as older adults and women. Addressing LBP not only improves individual quality of life but also reduces societal costs associated with disability and productivity loss. An integrative, demographic-sensitive approach must be prioritized in future health planning.

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The Pro-Apoptotic Effect of Diallyl Trisulfide (DATS) on MDA-MB-231 Breast Cancer Cells

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ABSTRACT

Introduction: Breast cancer is the most prevalent cancer globally, impacting almost 2.1 million people each year. The MDA-MB-231 exemplifies the aggressive nature of the triple-negative breast cancer (TNBC) subtype. Diallyl Trisulfide (DATS) in Allium sativum (garlic) demonstrates potential anticancer characteristics primarily by causing the generation of ROS that may trigger apoptosis.
Objective: The study evaluates the effect of DATS on apoptosis in MDA-MB-231 cells via the ROS pathway.
Methods: An in vitro study utilizing MDA-MB-231 cells, categorized into four groups: (1) Medium control, (2) Negative control, (3) 20 µM DATS after 24 hours, and (4) 40 µM DATS after 24 hours. The study used Annexin V-FITC/PI flow cytometry to measure apoptotic cell death, the MTT assay to measure cell viability, and DCFH-DA fluorescence to measure ROS production.
Results: Cell viability was decreased after DATS treatment and a substantial increase in intracellular ROS production was observed that varies with time and dose ($p < 0.001$). In comparison to the other groups, the group that received 40 µM DATS for 24 hours had the highest rate of apoptosis and the largest accumulation of reactive oxygen species (ROS).
Conclusions: DATS significantly elevates intracellular ROS levels to promote apoptosis in MDA-MB-231 cells as a pro-oxidant therapy for aggressive breast cancer.

Introduction

Breast cancer becomes a significant global issue, impacting over 2.1 million women annually, and is the most often diagnosed cancer as well as the world's fifth most common cause of cancer-related fatalities (Sung et al., 2021). Breast cancer is highly heterogeneous, with subtypes distinguished by the presence or absence of the HER2 and HR. Basal-like or TNBC has become the worst prognosis and the most aggressive subtype among these subtypes, as it lacks HR and HER2 expression. Chemotherapy continues to be the

conventional method for treating TNBC, yet, the effectiveness of treatment is sometimes compromised by the emergence of multidrug resistance (MDR), leading to therapeutic failure in advanced stages (Malla et al., 2022). Hence, the search for novel, more effective therapeutic agents, particularly for advanced TNBC unresponsive to chemotherapy, is urgently needed.

The GLOBOCAN 2020 database indicates that breast cancer resulted in 2.3 million new cases and 684,996 fatalities globally yielding a mortality-to-incidence ratio (MIR) of 0.30, which highlights inequalities in access to Early diagnosis and therapy (Sung et al., 2021; WHO, 2020). Almost 63% of worldwide breast cancer fatalities in 2020 transpired in Asia and Africa (WHO, 2020). In Indonesia, breast cancer represents a significant proportion of the national cancer burden, with 68,858 new cases (16.6% of all cancers) and over 22,000 deaths recorded in 2020 (Sung et al., 2021). National health data from Riskesdas (2018), ranked breast cancer as Indonesia's seventh most prevalent cancer to be diagnosed. and its prevalence is on the rise from 1.4 to 1.79 per 1,000 population between 2013 and 2018 (Kemenkes RI, 2019). In East Java, Breast cancer is the second most common malignancy, impacting roughly 0.5% of the population (Riskesdas, 2013), while in Surabaya City, 1.93% of suspected cases were identified in 2018 (Dinas Kesehatan Kota Surabaya, 2019).

Current dietary recommendations for breast cancer patients emphasize the consumption of garlic and vegetables, which are believed to offer broad anticancer benefits (Gan et al., 2017). Diallyl trisulfide (DATS) has demonstrated significant anticancer efficacy (De Gianni & Fimognari, 2015) and modulate critical cancer pathways by inhibiting phospholipase A2 and mitogen-activated protein kinases (MAPKs), cytochrome P450, and glutathione-S-transferase. Its effect on the redox-sensitive cellular microenvironment interferes involving cancer cell proliferation, tumor angiogenesis, and metastasis. Furthermore, DATS and its analogs, including DADS, modulate apoptotic and mitotic signals in breast cancer cells (Malla et al., 2022).

In vivo studies have demonstrated that DATS reduces TNBC metastasis via decreasing MMP-2/9 through the suppression of signaling pathways (Liu et al., 2018). DATS further inhibits proliferation and metastasis by targeting the STAT3 signaling pathway of cyclin D1, VEGF, BCL2, BCL-xL, and MMP-2 expression (Kim et al., 2020).

According Kiesel and Stan (2017), DATS is most effective in the first phases of breast carcinogenesis due to its focus on

Notch ligands (Jagged-1 and Jagged-2) and α-secretases (ADAM10 and ADAM17) in MDA-MB-231 cells. Conversely, other studies have reported that DATS is also effective in later stages by suppressing the Wnt/β-catenin pathway (Liu et al., 2018).

Given these findings, further research is essential to determine the mechanism by which Diallyl trisulfide causes apoptosis in TNBC. This study aims to assess the effect of DATS on the MDA-MB-231 breast cancer cell line, thorugh apoptosis mechanism by ROS.

Methods

Study Design

This experimental study was conducted at the Stem Cell Research and Development Center, Universitas Airlangga, Surabaya. Immunocyto-chemistry and TUNEL staining procedures were performed at the Department of Anatomical Pathology, Dr. Soetomo General Hospital, and the Laboratory of the Surabaya Infectious Disease Hospital (Ethical Clearance No. 0105/EC/KEPK/UNUSA/2024).

Cell culture

MDA-MB-231 cells line were used in this study, purchased from ATCC® HTB-26™, grown in DMEM supplemented with 10% FBS and 1% penicillin-streptomycin at 37°C with 5% CO_2.

Cell line revival and maintenance

Frozen MDA-MB-231 cells were quickly thawed in a 37°C water bath and moved into a 15 mL tube with 10 mL of warm RPMI-1640 medium. The cells were spun at 1200 rpm for 5 minutes, then the liquid was removed. The cells were mixed with 10 mL of RPMI-1640 with 10% FBS and placed in a T-25 flask. They were grown at 37°C with 5% CO_2. When about 80% full, the cells were split using 0.25% trypsin-EDTA, spun at 180 × g for 7 minutes, and moved to new flasks at 2,500–5,000 cells/cm² in fresh medium.

DATS preparation and treatment

Diallyl trisulfide (DATS) was obtained in pure form and dissolved in dimethyl sulfoxide (DMSO). In order to mitigate solvent-induced cytotoxicity, the ultimate concentration of DMSO in the culture medium was limited to 0.1% (v/v). Cells were divided into four experimental groups (each in duplicate wells, a total of 8 wells):

1. Medium Control**:** Wells with complete medium only, no cells.
2. Negative Control**:** MDA-MB-231 cells without any treatment.
3. DATS 20 μM (K24–20 μM)**:** Cells treated with 20 μM Diallyl Trisulfide for 24 hours.
4. DATS 40 μM (K24–40 μM)**:** Cells treated with 40 μM Diallyl Trisulfide for 24 hours.

Cells were seeded into plates, allowed to adhere overnight, and subsequently treated

with the designated concentrations of DATS for 24 hours.

Cell viability assay (MTT)

The study measured cell viability using the MTT assay in 96-well plates and incubated for 24 hours. Living cells produced purple formazan crystals, and disintegrated in 100 µL of DMSO.

Statistical Analysis

The study utilized Welch's ANOVA, followed by the Games–Howell post hoc test to ascertain statistically significant pairwise differences. Statistical significance was defined as a p-value of less than 0.05.

Results and Discussion

Comparison of the effect before DATS treatment on the cell death mechanism of MDA-MB231 via ROS pathway

The effect of diallyl trisulfide on the cell death mechanism of the MDA-MB231 cell line is shown in Figure 1. The post hoc analysis test revealed significant differences between the control and both DATS treatment groups (Table 1).

Additionally, a significant difference was observed between the two DATS concentrations, indicating a dose-dependent effect of DATS on MDA-MB231 cell death via the ROS pathway. Notably, the number of viable cells in the DATS-treated groups decreased significantly, approaching the level observed in the medium control group. This suggests that DATS effectively induces cell death in MDA-MB231 cells, potentially restoring cell viability closer to baseline conditions.

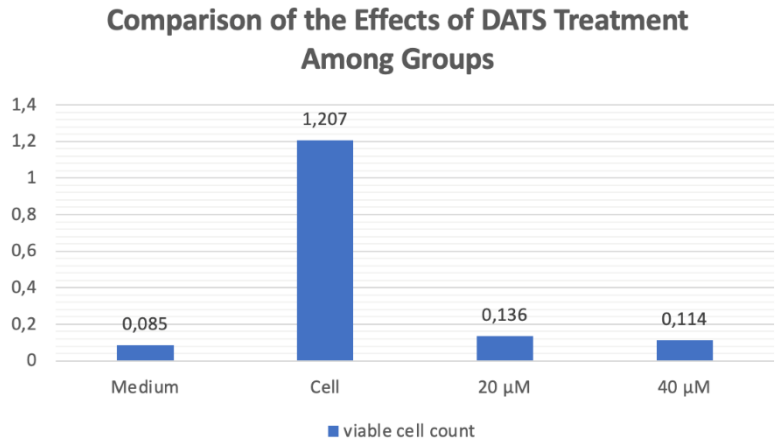

Figure 1. Comparison of DATS treatment versus control group

Table 1. Comparison test results for the effect of DATS on MDA-MB231 cell death via the ROS pathway

Group	Mean	Min	Max	p-value (Welch Anova test)
Medium Control	0.085	0.078	0.092	<0.001
Negative Control	1.207[a]	1.200	1.214	
DATS 20 µM	0.136[b]	0.129	0.143	
DATS 40 µM	0.114[c]	0.107	0.121	

Note: Data are presented as mean ± SD. Different superscript letters (a, b, c) indicate statistically significant differences between groups ($p < 0.05$)

Comparison of pre-treatment and post-treatment effects of DATS on MDA-MB-231 cell death via the ROS pathway

This study illustrates DATS impact in inducing MDA-MB-231 apoptosis through the ROS pathway, as depicted in Figure 5.1. The findings indicated a significant decrease of viable cells following DATS exposure, highlighting its cytotoxic potential and its promise as a future therapeutic option for inhibiting cell and inducing apoptosis in TNBC cells line.

These findings are consistent with prior research reporting that DATS at concentrations above 20 µM can reduce viable cell numbers by more than 50%, with the maximum effect observed after 72 hours of treatment (Kanga et al., 2021). Another study demonstrated that 40 µM DATS was more effective than 20 µM in suppressing MDA-MB-231 cell viability, with ROS production significantly increasing within the first 3 hours post-treatment, followed by a decrease after 6 hours (Chandra-Kuntal et al., 2013). The observations substantiate the essential function of ROS in facilitating apoptosis.

Prior studies indicate that DATS demonstrates significant cytotoxicity in breast cancer cell line, triggering apoptosis via caspase -3 and -9 (Marni et al., 2022). DATS is recognized for its inhibition of critical enzymes, including phospholipase A2, MAPKs, cytochrome P450s, and glutathione S-transferases, indicating its potential in cancer theraphy.

OSC-induced apoptosis include the activation of apoptotic protein. These effects are mediated by mitochondrial membrane disruption and enhanced ROS production (Na et al., 2012). The chemopreventive effects of DATS are thought mediated by interference with signaling pathways involved in inflammation, angiogenesis, invasion, and metastasis.

The effect of diallyl trisulfide on cell death mechanisms in MDA-MB-231 cells via the ROS pathway

The study demonstrated a substantial impact of DATS therapy and apoptosis in the breast cancer cell line that demonstrated by a reduction in the quantity of viable cells in the DATS-treated groups relative to the controls. These findings are verified by past studies that suggested a similar outcome as the study (Chandra-Kuntal et al., 2013).

DATS at concentrations of 20 μM and 40 μM were shown to trigger cell death and reduce cell viability, partly through the ROS-mediated apoptotic pathway. Additional studies have also demonstrated that 40 μM DATS can reduce cell viability by more than 50%, and the IC_{50} of DATS has been reported to be in the range of 30–40 μM (Kiesel & Stan, 2017).

DATS increases ROS production by influencing various cellular signaling pathways that which play a role in tumor growth including Akt, NF-κB, JNK, and ERK. DATS exhibits multiple biological functions, including anti-inflammatory activity, enhanced detoxification, histone acetylation, ROS generation, and ER stress (Shigemi et al., 2016). It is crucial to note that DATS has the ability to directly produce ROS by homolytically cleaving its intramolecular trisulfide bond. This process results in oxidative and ER stress, which in turn induces apoptosis in a variety of cancer cell types.

The JNK signaling axis is crucial in modulating cell survival and death during ROS generation triggered by DATS. This route is intricately connected to ferritin stability, which governs the release of labile iron and the ensuing production of deleterious reactive oxygen species (ROS) (Na et al., 2012).

The production of ROS by DATS is crucial for cancer cell migration and apoptosis. Activation of Bak, but not Bax, has been found to be ROS-dependent and crucial for apoptosis induction by DATS. Moreover, the pro-apoptotic protein Bim was found to be phosphorylated upon DATS treatment, further linking DATS exposure to ROS production and apoptosis induction (Puccinelli & Stan, 2017).

Conclusion

This study shown that Diallyl Trisulfide (DATS) can reduce MDA-MB-231 viability by inducing cell death via the ROS pathway with a dose-dependent effect. This substantiates the notion that reactive oxygen species (ROS) are pivotal in the mechanism by which DATS induces apoptosis in cancer cells. DATS exhibits promise as a natural anticancer agent, particularly against aggressive breast malignancies such as triple-negative breast cancer. Additional study is required to

investigate its application in animal studies and potential clinical uses.

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Anemia Gravis Caused by Chronic Multiple Infection of Helminthiasis on Geriatric: An Evidence-Based Case Report

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ABSTRACT

Introduction: Soil-transmitted helminth (STH) infections remain the most prevalent parasitic diseases globally. In elderly individuals, such infections can lead to significant morbidity, including anemia, fatigue, decreased activity levels, cognitive impairment, nutritional deficiencies, and gastrointestinal disturbances. This case report aims to highlight a rare instance of severe anemia caused by worm infestation in an elderly patient.

Case: A 57-year-old male presented with a 7-day history of fatigue, dizziness, and marked pallor, accompanied by worsening abdominal pain over the past 5 days. Physical examination revealed moderate illness with pale conjunctiva, a mildly distended abdomen, and hyperactive bowel sounds. Laboratory tests showed a significant drop in hemoglobin, hematocrit, erythrocyte count, serum iron, TIBC, and ferritin levels. Endoscopic evaluation revealed esophagitis, a Forrest III gastric ulcer, and multiple worms in the duodenum, later identified macroscopically as *Ascaris lumbricoides*.

Discussion: Worm infection is the most recent known diagnosis. The patient has undergone a complete stool analysis, but no worm eggs were found microscopically. This condition is very likely a false negative due to various factors, such as a less fresh stool sample (not examined immediately within 30 minutes) and human error by the analyst. The diagnosis was made after an endoscopic examination and multiple worms were found in the duodenum. When viewed from the large number of worms, it is likely that the patient has a severe and chronic worm infection. This is what causes the patient to suffer from anemia gravis with Hb 5.9.

Conclusions: Initial clinical and laboratory assessments led to a diagnosis of anemia gravis. The patient received three units of packed red cells. Further investigations confirmed microcytic hypochromic anemia due to iron deficiency and chronic inflammation, with parasitic infection as the underlying cause. Treatment with a single 400 mg dose of albendazole resulted in clinical improvement, allowing for safe discharge.

Introduction

Worm disease not only infects children, but also adolescents, adults, and the elderly. The most common worm infection is caused by soil-transmitted helminths (STH). Globally, an estimated 1.4 billion people

worldwide are infected with worms (WHO, 2023). The highest prevalence of worms is found in Asia, sub-Saharan Africa, China, and South America. Indonesia is the country with the largest prevalence in Southeast Asia (Harjono, *et al.* 2024). In Indonesia, the prevalence of STH infections is generally still high, especially in areas with poor sanitation (Sari SK, *et al* . 2024). A recent study in Indonesia reported that the prevalence of worms in children reached 30.5% with 67.2% infected by more than one type of intestinal parasite (Athiyyah, *et al*. 2023).

WHO targets worm infection control in 2025 to reach 75% of preschool and school-age children with regular treatment. Indonesia is included in the <75% coverage category based on the worm treatment and prevention program. Worm conditions in Indonesia have a prevalence of 45% -65%. In 2023, around 29 out of 100 children have health complaints in the past month. Where the highest child morbidity rate is in the 0-6 year age group of 13.55%, an increase from 11.74% in the previous year (Gunawan A, *et al.* 2024).

Worms in the elderly will have morbid effects in the form of anemia, weakness, drowsiness, laziness to learn, cognitive decline, impaired productivity, malnutrition, and abdominal disorders. Factors that cause the risk of worms in the elderly include food contaminated with worm eggs, not wearing shoes, indiscriminate defecation habits, being lazy to wash hands, not maintaining nail hygiene, not having a toilet in the house, lack of clean water availability, and socioeconomic factors, level of education and knowledge. STH worm infections are also transmitted due to the influence of environmental conditions, poor sanitation, such as water sources, human waste disposal, and food contamination (Sinaga S, et al. 2024).

One of the clinical manifestations of worms in the elderly is diarrhea due to poor hygiene and unhealthy living behavior (PHBS). Health problems related to personal hygiene in the elderly still receive less attention, so that they will cause health problems, such as worms, diarrhea and acute respiratory infections (ARI). According to WHO, 100,000 people die from diarrhea in Indonesia every year. According to the Ministry of Health, 300 out of every 1,000 people were infected with diarrhea throughout 2023 (Junaidin, *et al.* 2024).

The most worrying incidence of worms in adults is when they attack pregnant women. This condition is a health problem that requires serious attention. STH infection in pregnant women has a serious impact on the health of the mother and the development of the fetus she is carrying. Several studies have shown that worm

infections in pregnant women will cause serious complications, including anemia, stunted fetal growth, premature birth, and other pregnancy problems. Therefore, efforts to prevent worms in pregnant women and other adults do not only involve direct treatment, but also the importance of good personal hygiene as a preventive measure (Winarti, *et al* . 2024).

Based on this, it is very important to conduct further research on worms in adults and the elderly. Because research in Indonesia so far has only focused on toddlers and children. Worms in adults can cause complications in the form of anemia, decreased productivity, and concentration at work. The purpose of writing this article is to report the incidence of worm infections in the elderly, which are the cause of anemia gravis.

Case

A 57-year-old male patient came to the Banten Regional Hospital Emergency Room with complaints of weakness for 7 days before being admitted to the hospital. Complaints were accompanied by dizziness, fatigue, and the patient looked pale. The patient also complained of abdominal pain that had worsened over the last 5 days. Since 2021, the patient has complained of recurring abdominal pain and weakness, the patient has been treated three times at the nearest hospital from his home between 2021-2024, in the middle of the year the patient complained of black stools, abdominal pain, and worsening weakness so he was immediately directed to the Banten Regional Hospital Emergency Room. The patient looked thin with a body weight of 54 kg and a height of 163 cm. The patient had never experienced black stools before. Every day, the patient works in the rice fields and never wears footwear while working. There is no family history of similar experiences, and the patient also rarely washes his feet and hands with soap after going to work.

On physical examination, GCS 456 (compos mentis) was found. The patient appeared moderately ill, with a heart rate of 76 times per minute, body temperature of 36.7, pulse strong, and blood pressure 122/68 mmHg. Respiratory rate 20 times per minute, with SpO2 100% in room air. Head and neck: Anemic conjunctiva (+), cyanosis (-), jaundice (-), droopy eyes, enlargement of spleen (-), increase of jugular vein pressure (-). Thorax: symmetrical (+), bronchovesicular (+), rhonchi (-), wheezing (-). Abdomen: slightly distended, increased bowel sounds, pain on palpation (-), organomegaly (-). Extremities: pale warm acral, CRT < 2 seconds.

Initial laboratory examination, Hb: 5.9 (low), Hct: 22 (low), Leucocyte: 10.7 (high), Thrombocyte: 614 (high),

Erythrocyte: 3.0 (low), urea: 16, creatinine: 0.84, blood glucose at time: 79, sodium: 138, potassium: 4.4, chloride: 105. Based on the examination, the initial working diagnosis of the patient is anemia gravis. The patient was given first aid in the form of IVFD RL therapy 500 cc/8 hours, paracetamol tablets 500 mg, omeprazole capsules 20 mg, and transfusion of packed red cells (PRC) 3 pockets.

The next day, further laboratory examinations were performed in the form of peripheral blood analysis. Erythrocytes: anisocytosis, microcytic hypochromic dominance, polychromacy (+), ovalocytes (+), pencil cells (+), and 1/100 leukocytes were found to have a nucleus. Leukocyte count obtained 1/12/0/72/12/3, blast (-), with the impression: sufficient number, normal morphology, and hypereosinophilia (+). Platelet count increased, large platelets (+) are visible, and the distribution is even. Serum iron examination: 22 (low), total iron binding capacity: 239 (low), ferritin: 22.52 (low). Based on these examinations, the patient's diagnosis was hypochromic anemia. Microcytes and causa deficiency iron and inflammation chronic, hemoglobinopathy, hypereosinophilia, thrombocytosis reactive and suspected cause of infection by parasites. The patient was then given further therapy in the form of lansoprazole and iron tablets.

The next day, a routine blood test was performed as a follow-up to the PRC transfusion. The results showed an increase in Hb from 5.9 to 8.4, an increase in Hct from 22 to 29, an increase in erythrocytes from 3.0 to 3.8, a decrease in leukocytes from 10.7 to 9.0, and a decrease in platelets from 614 to 424. However, these changes were still not within normal limits. The patient's general condition seemed to improve, but the complaint of abdominal pain had not disappeared. The patient still received the same therapy as the previous day.

Next, immunoserology and hemostasis function examinations were performed on the patient. The results showed negative anti-HIV, non-reactive HBsAg, negative anti-HCV, prothrombin time (PT): 12.2, APTT: 42.1, INR: 0.93. In a complete stool examination, macroscopically it appeared brown, soft consistency, mucus (-), blood (-), typical stool odor, food residue (+). Microscopically, 1-2 leukocytes, 0-1 erythrocytes, macrophages (-) were found in the stool examination, amoeba (-), worm eggs (-), starch (-), fat (+), epithelium (+). The examination has not directed the etiology of anemia gravis experienced by the patient. The doctor referred the patient for an endoscopy.

Table 1. Patient laboratory examination results

Date	Results	Interpretation
8/23/2024 (Routine Blood Test)	Initial Hb: 5.9	Low
	Hct: 22	Low
	Leukocytes: 10.7	High
	Thrombocyte: 614	High
	Erythrocyte: 3.0	Low
8/24/2024 (Peripheral Blood Analysis)	Erythrocytes: anisocytosis is seen, microcytic hypochromic dominance, polychromacy (+), ovalocytes (+), pencil cells (+), and erythrocytes with nuclei are found in 1/100 leukocytes.	
	Leukocyte count obtained 1/12/0/72/12/3, blast (-), with the impression: sufficient number, normal morphology, and hypereosinophilia (+).	
	The number of platelets increased, large platelets (+) were seen, with even distribution.	
8/25/2024 (Iron Analysis)	SI: 22	Low
	TIBC: 239	Low
	Ferritin: 22.52	Low
8/23/2024 (Routine post-transfusion blood tests)	Initial Hb: 8.4	Low
	Hct: 29	Low
	Leukocytes: 9.0	Normal
	Thrombocyte: 424	High
	Erythrocyte: 3.1	Low

Endoscopic examination results showed grade II esophagitis in one-third of the lower esophagus, multiple ulcers were found in the gastric antrum, and multiple worms were found in the duodenum areas 1 and 2. Based on the endoscopy results, it was concluded that there was esophagitis, gastric ulcer Forrest III, and worm infection. Worms were taken from the duodenum and macroscopically identified as *Ascaris lumbricoides.* The patient was then given PPI drugs and albendazole 400 mg in a single dose. The patient's condition improved, and he was allowed to go home.

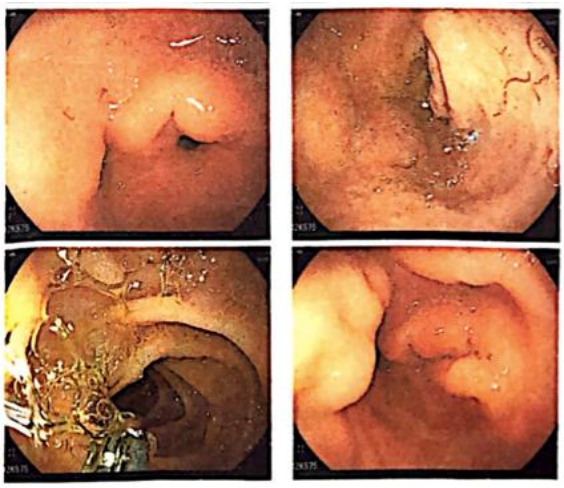

Figure 1. Multiple worms found in the duodenum on endoscopic examination

Source: Courtesy of Dr. Yugo Hario Sakti Dua, Gastroenterology Division, Department of Medicine, Banten Regional Hospital, Serang, Banten; with permission.

Figure 2. Findings multiple worms in duodenum-1 during endoscopic examination

Source : Courtesy of Dr. Yugo Hario Sakti Dua, Gastroenterology Division, Department of Medicine, Banten Regional Hospital, Serang, Banten; with permission.

Discussion

Worms, in a way can be cumulative and can cause the loss of substances that are useful for survival in elderly life, such as carbohydrates and proteins. Infection with worms can also cause anemia and complications for others. The Banten Provincial Health Service reported in 2023 that the prevalence of worm infestation varies from 2.5% to 62% in each city or district. The P2PL filariasis and worms sub-directorate stated that the prevalence of worm infestation in the Regency Pandeglang by 58.3% (Tjahyadi D, *et al.* 2024).

People whose work is often related to land, such as farmers, fishermen, plantation workers, and livestock breeders, are at risk of experiencing worms. Transmission can occur either orally (contamination of food and drink) or through skin penetration with direct contact with animal waste used as plant fertilizer. Animal waste contains eggs and worm larvae that can disrupt the ecological system, one of which is the transmission of worm disease in humans and animals (Anggraini, *et al.* 2020)

Based on WHO's report, World Wide Prevalence of Anemia, it was found that the total of the world's population suffering from anemia is 1.62 billion people. The results of the 2022 Riskesdas show that the proportion of anemia in the age group teen-adult by 18.4%. More than 267 million Indonesian residents live in areas that are the habitat of STH worms, so they need intervention prevention and treatment in an intensive way (Agustina, *et al.* 2021).

Man is the most common host to suffer from infection by parasite worm type intestinal nematodes. Worms this type is transmitted into the body through the soil and is still a problem. Health is spread widely in temperate regions and tropical areas such as Indonesia. Species classified as STH are *Trichuris trichiura, Ascaris lumbricoides*, and hookworms (*Ancylostoma duodenale* and *Necator americanus*). These worms will affect food intake, digestion, absorption and metabolism (Ginting, *et al.* 2022)

Intestinal nematodes usually mature in the small intestine. Most adult worms attach to the intestinal villi with suction cups, causing the host to lose nutrients and blood, until allergic reactions and intestinal irritation occur. Patients will experience decreased Hb function in exchanging oxygen carried throughout the body. In addition, there will be a decrease in the absorption of nutrients needed by the body, so that Hb levels decrease and cause anemia which has an impact on productivity disorders in the elderly (Husniar, *et al.* 2022).

Anemia is a symptom characterized by decreased Hb levels due to a lack of nutritional intake such as iron, folic acid and vitamin B12. In addition, anemia can also be caused by parasitic infections, such as malaria and worms. Adult worms that live in the human intestines contribute greatly to the incidence of anemia due to decreased Hb. Based on previous research in Banjarbaru City, it was found that STH worms cause blood loss of 2.2 cc/day or 66 cc/month. This condition causes a decrease in Hb levels as the intensity of infection increases (Nurmayani, *et al.* 2020).

Another study reported that someone with a history of worm infection will cause the patient to lose 0.08-0.34 cc/day of blood (Sucipto C, 2020). Therefore, worms can be dangerous because they cause iron deficiency anemia if chronic infection occurs. Iron deficiency anemia begins with normochromic microcytic. Then, as the iron deficiency worsens, it will become hypochromic microcytic. This condition is characterized by a decrease in the number of erythrocytes (RBC), Hb, Hct, MCV and MCHC. When anemia worsens, MCHC also decreases and thrombocytosis can occur. The risk of worms in this case can be prevented by washing hands, cutting nails, and wearing footwear (Wijaya, 2021).

The worms found in this case are the *Ascaris lumbricoides* species. The life cycle of this nematode begins with adult worms laying eggs in the small intestine. The immature eggs will come out with the feces. In a suitable environment, the fertilized eggs develop into an infective form in about 3 weeks. This infective form is then swallowed by humans, hatching in the small intestine into larvae. Then the larvae penetrate the wall of the small intestine to the lymphatic vessels or blood vessels. Furthermore, the larvae are carried by the bloodstream to the lungs. In the lungs, the larvae penetrate the alveolar walls and enter the tracheal cavity. From the trachea, the larvae rise to the pharynx, triggering a cough. This condition is known as Loefler's syndrome. When coughing, the larvae will be swallowed back into the stomach and small intestine. In the duodenum, the larvae develop into adult worms. This life cycle lasts for about 2 months (Ulfa AR, 2021).

Abdominal discomfort, diarrhea, nausea, vomiting, weight loss, and malnutrition are clinical symptoms of Ascaris lumbricoides worm infection. In addition, intestinal obstruction can also occur due to the bolus produced by the worm, and migrating larvae can cause pneumonia and eosinophilia. In patients with Ascariasis, all of these symptoms can be caused by adult worms and larvae that are usually located in the lungs. In people who are susceptible to infection, there is minor bleeding in the alveolar walls and lung symptoms such as cough, fever, and eosinophilia. Disorders caused by adult worms are usually mild and sufferers sometimes experience mild intestinal symptoms such as nausea, loss of appetite, diarrhea, and even constipation (Lydia L, *et al.* 2022).

Ascaris lumbricoides can produce about 20,000 eggs per day, or about two to three eggs per second, this can cause anemia, and if in large numbers can cause toxemia due to toxins produced by A. lumbricoides and appendicitis because adult worms can enter the lumen of the appendix. Adult worms can also cause lactose intolerance, malabsorption of vitamin A, and micronutrients. If the worms clump in the intestine, it can cause intestinal obstruction, or if adult worms enter the appendix, it can cause acute appendicitis. If adult worms enter and block the bile duct, they can cause colic, cholangitis, cholecystitis, pancreatitis, and liver abscess (Lydia L, *et al.* 2022).

STH worm infections are infections associated with the presence of body responses that produce several substances as mediators, causing type 1 hypersensitivity, such as eosinophils, basophils, and daln mast cells. IL-5 will cause the release of eosinophils, and activation of eosinophils will cause an increase in the amount of eosinophils in the blood. So it can be concluded that the high amount of eosinophils can indicate the presence of STH worm infections (Ulfiana D, *et al*. 2024).

In this case report, parasitic worm infection was the most recent diagnosis. The patient had undergone a complete stool analysis, but no worm eggs were found microscopically. This condition is very likely a false negative due to various factors, such as a less fresh stool sample (not examined immediately within 30 minutes) and human error by the analyst. The diagnosis was made after an endoscopic examination and multiple worms were found in the duodenum. When viewed from the large number of worms, it is likely that the patient had a severe and chronic worm infection. This is what caused the patient to suffer from anemia gravis with Hb 5.9.

Conclusion

A 57-year-old male patient came with complaints of weakness for 7 days before admission to the hospital. Complaints were accompanied by dizziness, fatigue, and the patient looked pale. The patient also complained of abdominal pain that had worsened over the last 5 days. On physical examination, the patient appeared moderately ill, with anemic conjunctiva (+), abdomen: slightly distended, and increased bowel sound. On initial laboratory examination, Hb: 5.9 (low), Hct: 22 (low), Leucocyte: 10.7 (high), Thrombocyte: 614 (high), Eritrocyte: 3.0 (low) were obtained. Based on these examinations, the initial working diagnosis of the patient was anemia gravis. The patient was given first aid in the form of IVFD RL therapy 500 cc/8 hours, paracetamol tablets 500 mg, omeprazole capsules 20 mg, and packed red cell (PRC) transfusion 3 pockets. On further laboratory examination in the form of peripheral blood analysis. Erythrocytes: anisocytosis, microcytic hypochromic dominance, polychromacy (+), ovalocytes (+), pencil cells (+), and erythrocytes with nuclei were found in 1/100 leukocytes. Leukocyte count showed 72 eosinophils, with an impression of hypereosinophilia (+). The number of platelets increased, large platelets (+) were seen. Serum iron examination: 22 (low), total iron binding capacity: 239 (low), ferritin: 22.52 (low). Based on these examinations, the patient was diagnosed with hypochromic anemia. Microcytes and causa iron deficiency and chronic inflammation, hemoglobinopathy, hypereosinophilia, thrombocytosis reactive and suspected cause infection parasites. The patient was then given further therapy in the form of lansoprazole and iron tablets. Next, a routine blood test was performed as a follow-up to PRC transfusion. The results showed an increase in Hb from 5.9 to 8.4. The results of the endoscopy examination showed grade II esophagitis in the lower third of the esophagus, multiple ulcers were found in the gastric antrum, and multiple worms were seen in the duodenum area 1 and 2. Based on the results of the endoscopy, it was concluded that there was esophagitis, gastric ulcer Forrest III, and worm infection. Worms were taken from the duodenum and macroscopically identified as *Ascaris lumbricoides.* The patient was then given PPI drugs and a single dose of albendazole 400 mg. The patient's condition improved and he was allowed to go home.

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