

Acute respiratory tract infections in elementary school-aged children at Tamalanrea Health Centre Makassar: identification of bacteria with gram staining of patients

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Abstract: This research is designed to Determine bacterial patterns in ARI patients in children based on gram staining and identify the dominant bacteria in ARI patients with gram staining. A cross-sectional descriptive design, using a specimen from the throat swab of an elementary school student with ISPA who visited the Tamalanrea Makassar Health Centre between October 10, 2021 until November 10, 2021. We obtain 57 samples of throat swab from ISPA patients. The throat swab results revealed 14 different bacterial morphologies, including gram-positive-bacilli 3 (5.2%) and 2 gram-positive diplobacilli (3.5%). While Gram-negative-bacilli 5 (8.7), gram-negative diplobacilli 2 (3.5%), streptobacilli 2 (3.5%), gram negative coccus 4 (7.2%), diplococcus gram negative 2 (3.5%), and gram-negative-coccobacillus 5 (8.7%) are gram positive for streptobacilli 3 (5.2%), gram-positive-coccus 3 (5.2%), staphylococcus 7 (12.4), and gram-positive-coccobacil 2 (3.5%). Examination using Gram staining revealed that, among ISPA patients who were elementary school-aged children, gramme positive bacteria (50.9%) were the most common type, compared to gramme negative bacteria in 20 samples (35.1%) and polymicrobial results in 8 samples (14%).

Keywords: Acute Respiratory Infection (ARI), Gram Staining, Throat Swab.

1. Introduction

ARI, or Acute Respiratory Infection, is a condition that affects the respiratory tract, including the nose, throat, and lungs.¹ Typically, ARI often becomes the primary cause of illness in children aged 1-6 years. According to the World Health Organization (WHO), ARI is one of the leading causes of death in children in developing countries, and Indonesia is one of the developing countries with the highest number of ARI cases.^{2,3} Data from Indonesia's Health Profile in 2021 recorded approximately 4,432,177 ARI cases in children.⁴

The high incidence of ARI in Indonesia is closely related to the rate of infectious agent transmission, which is the primary cause of ARI. To establish an ARI diagnosis based on the infectious agent causing it, laboratory examinations involving throat swab samples from patients with ARI symptoms can be conducted.⁵

Gram staining is an empirical method used to differentiate bacterial species into two major groups, namely, Gram-positive and Gram-negative bacteria. Gram-positive bacteria have cell walls with thick peptidoglycan layers that appear purple when stained, while

Gram-negative bacteria have cell walls with thinner peptidoglycan layers that appear pale pink or red when stained.

Tamalanrea Health Center is one of the health centers located in Makassar city, situated in the Tamalanrea sub-district. It serves two working areas, namely the Tamalanrea and Buntusu sub-districts, with a population density in the Tamalanrea sub-district reaching 103,947 residents (Dukcapil, 2019). Data collected by researchers from January to May 2022 revealed that 210 ARI patients, including sinusitis, tonsillitis, pharyngitis, laryngitis, pneumonia, and common cold, underwent examinations at the Tamalanrea Community Health Center

2. Methods

In this study, the method employed is laboratory testing with a descriptive research design. The research design is utilized to identify the bacterial patterns in patients with Acute Respiratory Tract Infection (ISPA) in children based on gram staining. The research was conducted in October-November 2022 at the Tamalanrea Community Health Center, and the laboratory examinations were carried out at the Research Laboratory of the Faculty of Medicine and Health Sciences, UIN Alauddin Makassar.

The population of this study consists of patients experiencing ISPA who visited the Tamalanrea Community Health Center. The research sample comprises acute respiratory tract infection patients who underwent throat swab testing among school-age children at the Tamalanrea Community Health Center in Makassar, with a total sample size of 57.

The data source used in this study is primary data obtained from the results of gram staining examinations of throat swabs. Meanwhile, secondary data is derived from medical records, including the number of ISPA cases and personal information about the patients. The research data on the identification of bacteria from throat swab samples of ISPA patients will be described descriptively in tabular form to observe the quantity of dominant bacterial patterns in ISPA patients. The bacterial identification results are obtained through gram staining tests.

3. Result

The samples collected in this study reached 57, with samples taken from throat swabs of patients, and the data obtained is as follows:

Table 1 The characteristic of participants (n: 57).

Characteristics		Total (n = 57)	Weighted (%)
Age (years)	6	16	28
	7	15	26.4
	8	9	15.8
	9	4	7
	10	6	10.6
	11	4	7
	12	3	5.2
Gender	Male	38	66.7
	Female	19	33.3

Source: Primary Data, 2022

Table 1 explains that in the age category, most children are in the age range of 6-8 years, namely 6 years with 16 children (28%), 7 years with 15 children (26.4%), and 8 years with 9 children (15.8%). Furthermore, for the gender category, the majority of patients who are the subjects of the study are male, with 38 children (66.7%), while females are 19 children (33.3%).

Table 2 Characteristics of Clinical Symptoms in ISPA Patients of participant

Characteristics	Total	Weighted (%)
cough	57 patients	100
Common cold	57 patients	100
Fever	27 patients	47.3
Sore throat	7 patients	12.2

Source: Primary Data, 2022

Based on Table 2, it was found that out of 57 patients diagnosed with ISPA, all 57 individuals (100%) experienced symptoms of cough and cold. However, among the 57 patients with cough and cold symptoms, only 7 children (12%) complained of sore throat, and 27 (47.3%) experienced fever.

Table 3 Gram Staining in Patients with Acute Respiratory Tract Infections (n: 497).

Gram staining results	Morphology	Total (n = 57)	Weighted (%)
Gram-positive bacteria	Bacil	3	5.3
	Diplobacil	2	3.5
	Streptobacil	3	5.2
	Coccus	3	5.2
	Diplococcus	4	7.2
	Streptococcus	5	8.7
	Staphylococcus	7	12.4
	Coccobacil	2	3.5
Gram-negative bacteria	Bacil	5	8.7
	Diplobacil	2	3.5
	Streptobacil	2	3.5
	Coccus	4	7.2
	Diplococcus	2	3.5
	Coccobacil	5	8.7
Polymicrobial		8	14.0

Table 3 shows that out of 57 samples, 14 bacterial morphologies were found in the throat swab results. These include Gram-positive bacilli with 3 (5.2%), Gram-positive diplobacilli with 2 (3.5%), Gram-positive streptobacilli with 3 (5.2%), Gram-positive cocci with 3 (5.2%), Gram-positive diplococci with 4 (7.2%), Gram-positive streptococci with 5 (8.7%), Gram-positive staphylococci with 7 (12.4%), and Gram-positive coccobacilli with 2 (3.5%). Meanwhile, Gram-negative bacteria consist of bacilli 5 (8.7%), Gram-negative diplobacilli 2 (3.5%), Gram-negative streptobacilli 2 (3.5%), Gram-negative cocci 4 (7.2%), Gram-negative diplococci 2 (3.5%), and Gram-negative coccobacilli 5 (8.7%).

Table 4 Result of Gram Staining Identification

Characteristics	Total	Weighted (%)
Gram-positive bacteria	29	50.9%
Gram-negative bacteria	20	35.1%
Polymicrobial	8	14%
PMN leukocytes	5*	
Epithel	45**	

*Number of findings of PMN leukocytes from 57 samples.

**Number of epithelial findings identified from 57 samples.

From Table 4, it was found that the dominant bacteria in patients with ISPA in this study are Gram-positive bacteria, with 29 samples (50.9%), compared to Gram-negative bacteria, which are found in 20 samples (35.1%). Furthermore, out of the 57 samples, polymicrobial results were found in 8 samples (14%), with 5 samples showing the presence of PMN leukocytes and epithelial cells in 45 samples overall.

Figures

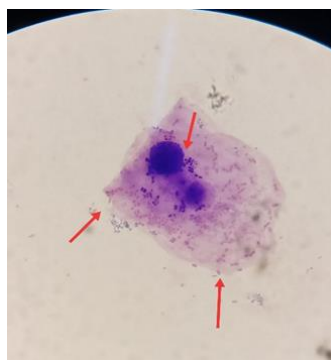


Figure 1 Streptococcus

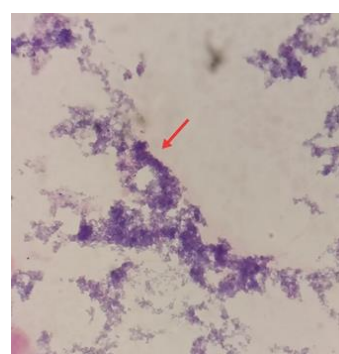


Figure 2 Staphylococcus

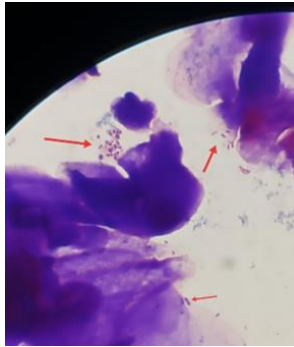


Figure 3 Coccus Gram Positive

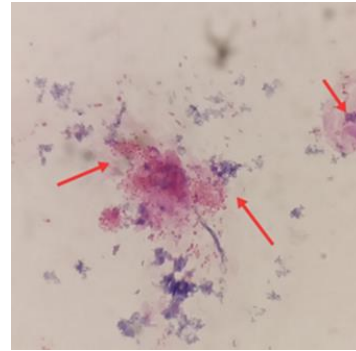


Figure 4 Coccus Gram Negative

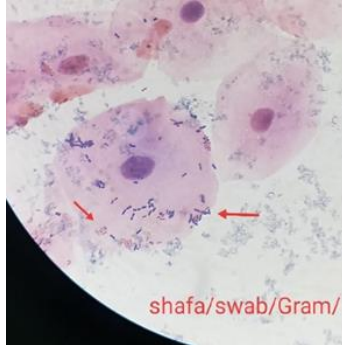


Figure 5 Bacil Gram Positif

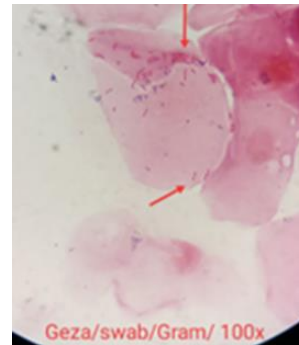


Figure 6 Bacil Gram Negatif

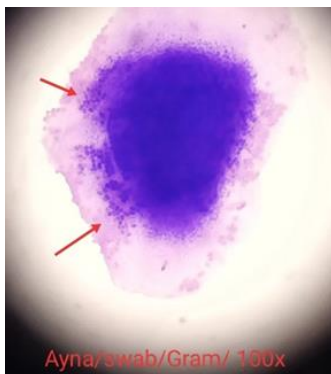


Figure 7 Cocobacil Gram Positif

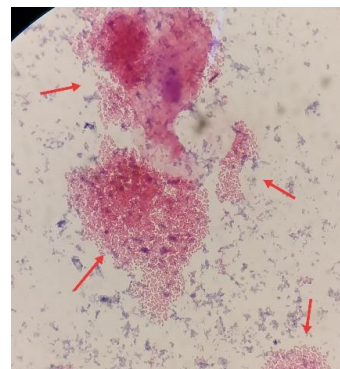


Figure 8 Cocobacil Gram Negatif

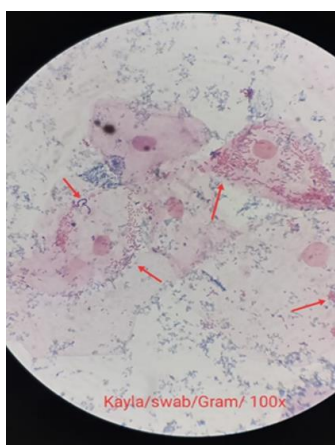


Figure 9 Polymicrobial and Epithel

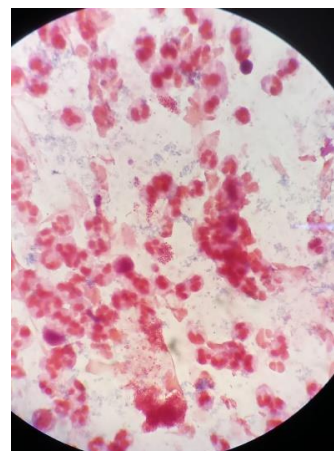


Figure 10 PMN leukocytes

4. Discussion

In this study, various types of bacteria were found in throat swab results, including Gram-positive Streptococcus, Gram-positive Staphylococcus, Gram-positive basil, Gram-positive cocci, and Gram-positive coccobacilli. Meanwhile, Gram-negative bacteria consisted of basil, Gram-negative cocci, and Gram-negative coccobacilli. The results obtained are in line with the theory that ARI (Acute Respiratory Infection) is an infection caused by microorganisms in the upper respiratory tract that impairs gas exchange, involving the nasal, pharyngeal, and laryngeal passages.⁶

Bacteria causing ARI are classified into 2 groups, namely Gram-positive bacteria and Gram-negative bacteria. The relative differences between these bacteria lie in the characteristics of their cell wall structures. Various bacteria causing ARI include Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus spp, Klebsiella pneumoniae, Mycoplasma pneumoniae, Branhamella, Pseudomonas, Escherichia, and Proteus. The variation in research results regarding the bacteria found indicates that Gram-positive bacteria are often found more, but sometimes Gram-negative bacteria can be found more than Gram-positive bacteria.⁷

In this study, Gram-positive bacteria are the most dominant compared to Gram-negative bacteria. This is consistent with the research conducted by Lutfiana Wulfa (2016), which found that Gram-positive bacteria dominated in ARI patients in adults. Similarly, in the study conducted by Oktafin (2016), which identified the pattern of aerobic bacteria in ARI patients, the results showed a higher prevalence of Gram-positive bacteria compared to Gram-negative bacteria. However, in this research, it was conducted on school-age children and limited to Gram staining, and it can only identify bacteria based on morphology without reaching more advanced bacterial examinations. Therefore, the researchers were unable to identify bacteria at a more specific level.^{8,9}

In some samples, the results of polymicrobial identification were found in 8 samples, with 5 samples showing the presence of PMN leukocytes and epithelial cells in 45 samples overall. Polymicrobial infection is caused by 3-10 infectious agents or microorganisms, while the presence of epithelial cells and PMN cells seen in the staining results at a magnification of 400x indicates an acute infection.

The epithelium observed in the staining results is the non-keratinized squamous epithelium from throat swabs of ARI patients. These epithelial cells are shed during infections, serving as a protective response aimed at eliminating the initial causes of cell damage. Tissue inflammation is a localized protective response triggered by tissue injury or damage, functioning to destroy, reduce, or contain (sequester) both the agents causing the injury and the affected tissue.¹⁰

The PMN cells seen in the staining results represent innate immunity, which is a non-specific defense mechanism that prevents the entry and spread of microorganisms within the body and prevents tissue damage. An increase in PMN cell count occurs during the infection process through the migration of PMN cells to infected tissues, initiating the phagocytosis of bacteria and dead tissue cells.¹¹

The limitations in this study include a sufficiently large number of samples, preventing bacterial cultivation, resulting in inconsistent findings. Additionally, the age criteria for the

samples in this study involve children, making throat swab collection challenging. Recommendations for future researchers, we hope that further research can be conducted on more specific bacterial species with a larger sample size.

5. Conclusion

Based on the data obtained in this study, it can be concluded that the number of pediatric patients with ARI at the Tamalanrea Public Health Center in Makassar who were willing to become samples in this study was 57 children. Subsequently, sample collection was carried out using throat swabs, followed by bacterial staining using the direct Gram stain method. The staining results of bacterial samples from pediatric ARI patients at the Tamalanrea Public Health Center in Makassar showed a dominant presence of Gram-positive bacteria with a percentage of 50.9%, compared to 35.1% Gram-negative bacteria.

Ethical Aspects

This research has obtained ethical approval with the number B.2xx/KEPK/FKIK/IX/2022. We ask patient consent before they become participants and provide information to the patients through informed consent.

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