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Research Article

Knowledge, Awareness, and Practice of Parents on Antibiotic Resistance among Children in Sampang, Cilacap Regency

Pengetahuan, Kesadaran, dan Praktik Orang Tua tentang Resistensi Antibiotik Pada Anak di Sampang, Kabupaten Cilacap

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ABSTRACT

Inappropriate use of antibiotics in children contributes to antibiotic resistance. Parents in Cilacap have limited knowledge and awareness of this issue. This study aimed to describe the knowledge, awareness, and practices of parents regarding antibiotic resistance in children aged 0-11 years old in Cilacap, as well as to explore the relationship of those aspects and the respondents' characteristics. The research used a descriptive cross-sectional approach in Sampang District, Cilacap Regency, conducted in May 2024 with 96 respondents selected through cluster random sampling who met the inclusion criteria. The respondents were parents of children aged 0-11 years old, with or without antibiotic treatment history, and willing to participate by completing questionnaires. Results showed that 61 respondents (63.5%) had high knowledge, 64 respondents (66.7%) had high awareness, and 63 respondents (65.6%) had good practices. The chi-square test results further indicated that age and education significantly influenced knowledge, awareness, and practices, with p-values <0.05. Meanwhile, gender and occupation showed no significant effect, as evidenced by p-values >0.05. The findings indicate that parents in Sampang District generally demonstrate high knowledge and awareness, as well as good practices concerning antibiotic resistance in children. However, certain demographic factors, particularly age and education, remain influential in shaping these outcomes.

Keywords: Antibiotics, Awareness, Knowledge, Parents, Practice

ABSTRAK

Penggunaan antibiotik yang tidak tepat pada anak berkontribusi terhadap resistensi antibiotik. Orang tua di Cilacap masih memiliki pengetahuan dan kesadaran terbatas mengenai masalah ini. Penelitian ini bertujuan untuk menggambarkan pengetahuan, kesadaran, dan praktik orang tua terkait resistensi antibiotik pada anak usia 0-11 tahun di Cilacap, serta mengeksplorasi hubungannya dengan karakteristik responden. Penelitian ini menggunakan metode deskriptif dengan pendekatan cross-sectional di Kecamatan Sampang, Kabupaten Cilacap, pada Mei 2024 dengan 96 responden yang dipilih melalui cluster random sampling dan memenuhi kriteria inklusi. Responden adalah orang tua dengan anak usia 0-11 tahun, baik dengan maupun tanpa riwayat penggunaan antibiotik, serta

bersedia berpartisipasi mengisi kuesioner. Hasil penelitian menunjukkan bahwa 61 responden (63,5%) memiliki pengetahuan tinggi, 64 responden (66,7%) memiliki kesadaran tinggi, dan 63 responden (65,6%) memiliki praktik yang baik. Hasil uji chi-square menunjukkan bahwa usia dan pendidikan berpengaruh signifikan terhadap pengetahuan, kesadaran, dan praktik dengan nilai p <0,05. Sementara itu, jenis kelamin dan pekerjaan tidak menunjukkan pengaruh signifikan, dibuktikan dengan nilai p >0,05. Temuan ini mengindikasikan bahwa orang tua di Kecamatan Sampang umumnya memiliki pengetahuan dan kesadaran yang tinggi serta praktik yang baik mengenai resistensi antibiotik pada anak, meskipun faktor demografis tertentu, khususnya usia dan pendidikan, tetap berpengaruh dalam membentuk hasil tersebut.

Kata Kunci: *Antibiotik, Kesadaran, Orang tua, Pengetahuan, Praktik*

INTRODUCTION

Data from *The Lancet* reported that 4.95 million deaths associated with Antimicrobial Resistance (AMR) in bacteria in 2019, of which 1.27 million were directly attributed to bacterial resistance (1). According to the Indonesia Antimicrobial Resistance Surveillance System (INARSS) in 2019 and 2020, there was an increasing percentage of AMR in Indonesia, such as *Escherichia coli* showing resistance to third-generation cephalosporins and fluoroquinolones at 66.7% and 65.6%, respectively, and *Klebsiella pneumoniae* exhibiting resistance at 74.4% and 53.2% (2). The main causes of AMR in Indonesia include the inappropriate and irrational use of antibiotics and non-adherence to prescribed treatment regimens (3).

An evaluation of the appropriateness of antibiotic use at Hospital “X” in 2018 indicated that correct drug selection was only 23.53%, while correct dosage (including amount, frequency, route, and duration) was 64.71%, reflecting a low level of therapeutic adherence (4). The increasing incidence of bacterial infections has consequently led to higher antibiotic consumption, which may elevate the risk of antibiotic resistance, particularly among paediatric populations (5). Therefore, antibiotic use must adhere to rational principles, encompassing accurate diagnosis, appropriate indication, drug selection, dosage, route and interval of administration, duration of therapy, as well as comprehensive communication of information and patient condition assessment, in order to minimise the potential for antibiotic resistance (4).

Antibiotic resistance represents a major threat to public health, particularly among children. The key concerns in paediatric populations include the emergence of Methicillin-Resistant *Staphylococcus aureus* (MRSA), Vancomycin-Resistant *Staphylococcus aureus* (VRSA), Extended Spectrum Beta-Lactamase (ESBL)-producing *Enterobacteriaceae*, carbapenem-resistant *Enterobacteriaceae*, and the alarming rise of colistin resistance (6). The use of antibiotics between children and adults is different, since antibiotic administration in children requires appropriate parental involvement to ensure proper utilisation (7).

Parental knowledge and attitudes play a crucial role in the appropriate use of antibiotics in children. A study conducted in Tomang Subdistrict revealed that limited maternal knowledge regarding antibiotics may negatively influence attitudes and behaviours related to antibiotic use in children (8). Previous research has also demonstrated that adequate parental understanding of antibiotics can promote more appropriate antibiotic use in children (9).

Previous studies have shown that approximately 58.5% of parents administered antibiotics to their children based on previous personal experience with antibiotic use (10). Experience in obtaining information can influence a person’s level of knowledge. Individuals who acquire information from various sources tend to demonstrate a better understanding and awareness (9). Understanding parents’ knowledge, attitudes, and practices regarding antibiotic use is essential for developing targeted educational interventions and increasing awareness to prevent unnecessary and inappropriate antibiotic use (11).

Awareness of AMR within the community is crucial, as the excessive or inappropriate use of antibiotics can lead to bacterial resistance, rendering antibiotics ineffective in treating future infections. Moreover, antibiotic resistance has several adverse impacts, including an increase in hard-to-treat infections, higher healthcare costs, and a decline in the effectiveness of available antibiotics (12). This study was conducted in Sampang District, Cilacap Regency, as no previous research has examined parents' knowledge, awareness, experiences, and attitudes regarding antibiotic resistance in children in this area.

Based on the aforementioned background, the researcher is interested in conducting a study entitled "Knowledge, Awareness, and Practices of Parents on Antibiotic Resistance among Children in Sampang, Cilacap Regency". This study is further expected to serve as a foundation for future research on the level of parents' knowledge, awareness, experiences, and attitudes regarding antibiotic resistance, as well as to provide information on the appropriate use of antibiotics. The aim of this study is to describe the knowledge, awareness, and practices of parents with respect to antibiotic resistance in children in Sampang, Cilacap Regency.

METHODS

This study employed a quantitative descriptive design with a cross-sectional approach. A cross-sectional study measures data on independent and dependent variables only once at a certain time (13). The study was conducted from March to May 2024 in Sampang, Cilacap Regency. The population consisted of parents residing in the Sampang District area, with a total sample of 96 respondents who met the predetermined inclusion criteria. In this case, the inclusion criteria were parents who had children aged between 0 months and 11 years old, parents whose children had received antibiotic treatment or not, and parents who were willing to participate and complete the questionnaire. Furthermore, the sample size was determined using the Lemeshow formula, resulting in 96 participants, and the sampling technique used was cluster random sampling. The instrument used in this study was a questionnaire. The questionnaires on knowledge and practices were adopted from a previously published journal (14), while the awareness questionnaire was adopted from another published journal (15). In total, there were 34 questions covering various aspects related to knowledge, awareness, and practices regarding antibiotic use. The levels of knowledge and awareness were classified into two categories: low (<50%) and high (≥50%), whereas the level of practices was categorised as poor (<50%) or good (≥50%).

The questionnaire used as a research instrument was tested for validity and reliability. The validity and reliability tests were conducted from 30th March to 5th April 2024 in Sampang, Cilacap Regency, involving 30 respondents. The validity test was performed by tabulating data using Excel, followed by analysis with SPSS. In this case, an item was considered valid if the calculated *r*-value was greater than the *r*-table value. The reliability test was carried out on all questionnaire variables using Cronbach's alpha formula, in which an alpha value greater than 0.7 indicates acceptable reliability (16). The results of the validity test showed that all 34 questions were valid, with *r*-value exceeding the *r*-table value (0.361). In addition, the reliability test results indicated that the instrument was reliable, with a Cronbach's alpha value meeting the required criterion of alpha >0.6, namely 0.865.

This study was conducted in three stages, namely the preparation stage, the implementation stage, and the final stage. The preparation stage included a preliminary survey, the development of a research proposal, ethical clearance, validity and reliability testing, and the acquisition of research permits. The implementation stage involved submitting research permission letters to the district and village offices. Once approval was obtained, the study was carried out. During the implementation stage, respondents were first given a brief explanation regarding antibiotic resistance. Subsequently, informed consent forms and questionnaires were distributed. Respondents were asked to complete the informed consent forms and questionnaires thoroughly and truthfully. After completion, the researcher collected the questionnaires for data compilation. The final stage consisted of data entry and processing using SPSS, followed by the preparation of research results and discussion. This study obtained ethical approval from the Research Ethics Committee of Universitas Harapan Bangsa under approval number B/LPPM-UHB/186/06/2024.

Data Analysis

Data analysis in this study employed *Chi-square* test without conducting a homogeneity test. The *Chi-square* test was applied to assess the presence or absence of a relationship between the dependent and independent variables using SPSS version 25. In this case, the homogeneity test was not performed, as the *Chi-square* test is a non-parametric test that does not require the assumptions of normality or homogeneity of data (17).

RESULTS

Respondent Characteristics

Table 1. Characteristics of Respondents with Antibiotic Treatment in Children

Respondent Characteristics	Category	Number	Percentage (%)
Age (Years)	18-30	28	29.2
	31-50	52	54.2
	>50	16	16.6
Sex	Male	17	17.7
	Female	79	82.3
Occupation	Employed	71	74.0
	Unemployed	25	26.0
Education	Low (Primary-Junior High School)	31	32.3
	Intermediate (Senior High School)	24	25.0
	Higher (University)	41	42.7

Overview of Parents' Knowledge, Awareness, and Practices on Antibiotic Resistance in Children

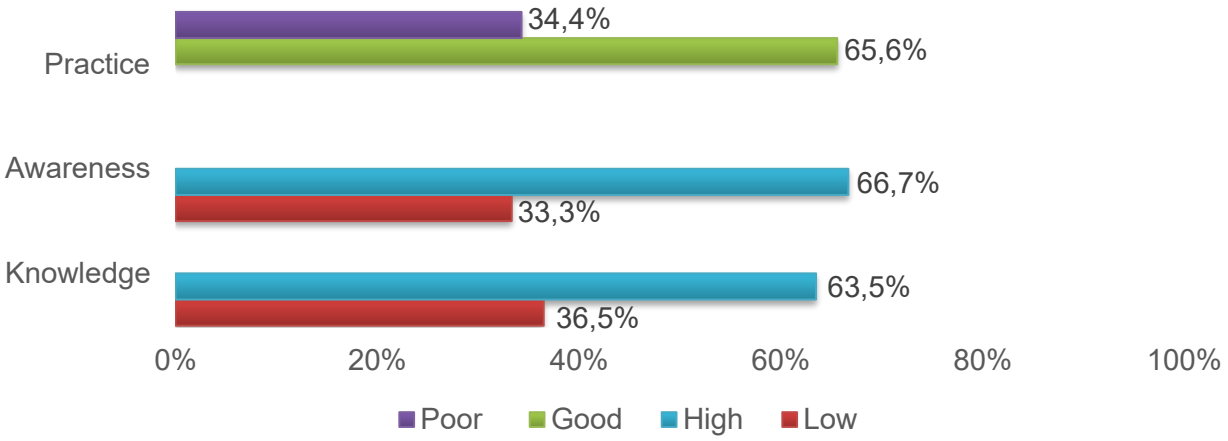

Figure 1. Distribution of respondents whose children received antibiotic treatment

Questionnaire Frequency Distribution

Frequency Distribution of Parental Knowledge Questionnaire on Children's Antibiotic Treatment

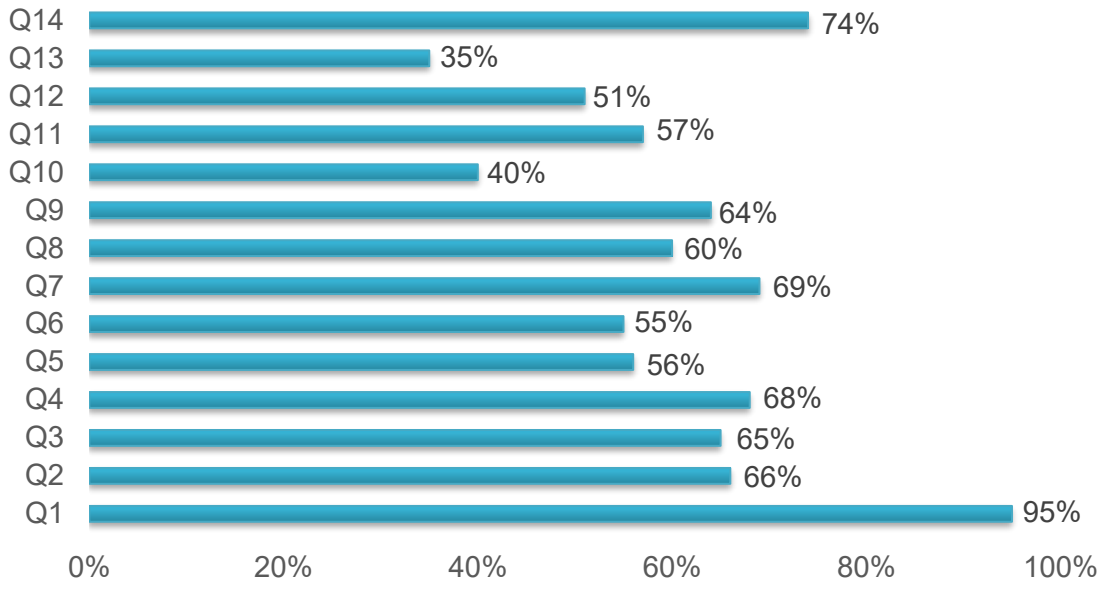

Figure 2. Frequency distribution of the questionnaire on parental knowledge of children's antibiotic treatment

Description:

Q1 : Antibiotics should be administered according to a doctor's recommendation, even when the symptoms of the illness start to improve
Q2 : Antibiotics need to be given whenever a child is ill, regardless of the disease
Q3 : Antibiotics must be prescribed when other medications show no therapeutic effect
Q4 : Antibiotics are used to treat diseases caused by viral infections
Q5 : Coughs require antibiotic treatment
Q6 : Fever should be treated using antibiotics
Q7 : Misuse of antibiotics can lead to prolonged recovery
Q8 : Diarrhea is a condition that requires antibiotic treatment
Q9 : Inappropriate use of antibiotics can lead to bacteria becoming resistant to antibiotics
Q10 : Inappropriate antibiotic use can increase medical costs
Q11 : Antibiotics can kill the "good bacteria" in the body
Q12 : Penicillin or Amoxicillin are examples of antibiotics
Q13 : Paracetamol is an example of an antibiotic
Q14 : Antibiotic resistance is a phenomenon in which antibiotics lose their ability to kill bacteria

Distribution of the Questionnaire Frequency on Parental Awareness of Children's Antibiotic Treatment

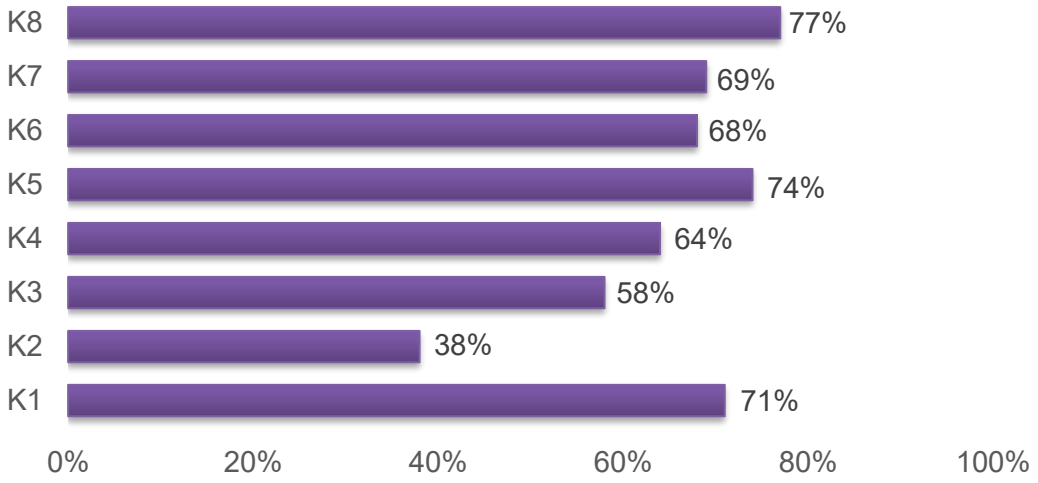

Figure 3. Frequency distribution of the questionnaire on parental awareness of children's antibiotic treatment

Description:

K1 : I have heard or encountered the term *"antibiotic resistance"* before. Sources of information:
1. Healthcare professionals
2. Mass media
3. Friends

K2 : I know what the term "Antibiotic Resistance" means

K3 : I have been informed about "How often" and "How much" to take antibiotics, either verbally and/or in written form

K4 : In my opinion, the development of Antibiotic Resistance is a serious problem

K5 : Unnecessary use of antibiotics can increase bacterial resistance to these drugs

K6 : Antibiotic resistance is a global problem

K7 : The following, in your opinion, are risk factors for antibiotic resistance:
1. Overuse or misuse of antibiotics
2. Failure to complete the full course of treatment
3. Sharing antibiotics with others
4. Taking antibiotics without a doctor's prescription
5. Taking antibiotics without regard to dose or dosing interval

K8 : The following, in your opinion, are consequences of antibiotic resistance:
1. Reduced antibiotic activity
2. Increased need for costly treatments
3. Failure to recover from illness
4. Increased severity and duration of disease

Distribution of the Parental Practice Questionnaire on Children's Antibiotic Treatment

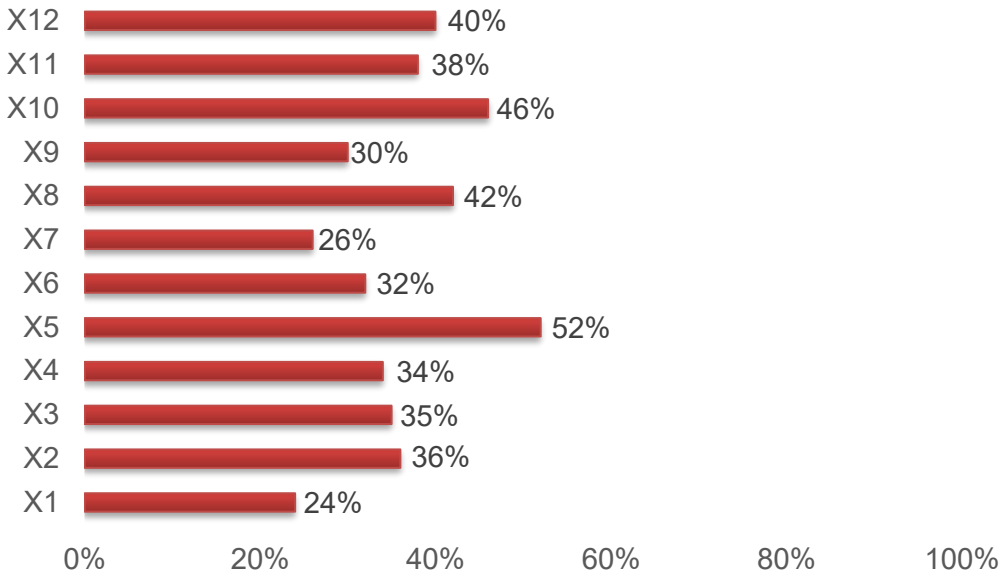

Figure 4. Frequency distribution of the questionnaire on parental practices regarding children's antibiotic treatment

Description:

X1 : I can treat my child with antibiotics without consulting a doctor or pharmacist
X2 : I decide to give antibiotics for self-medication if my child's illness does not improve after a few days
X3 : I decide to give antibiotics for self-medication as soon as my child's symptoms (such as cough and fever) appear
X4 : I give my child antibiotics for self-medication after receiving advice from family members or friends
X5 : I determine the dosage or amount of antibiotics for my child's self-treatment after reading the leaflet or information on the medication packaging
X6 : I give my child antibiotics for self-medication based on my previous experience
X7 : I give my child antibiotics for self-medication after reading information on the internet
X8 : I stop giving antibiotics to my child once the symptoms have disappeared
X9 : I stop giving antibiotics to my child after 3–5 days, regardless of the outcome or improvement
X10 : I obtain antibiotics for self-medication from a pharmacy
X11 : I obtain antibiotics for self-medication for my child from antibiotics previously used
X12 : I obtain antibiotics for self-medication for my child from friends, family, or neighbours

Relationship Between Knowledge and Respondents' Characteristics

Table 2. Relationship Between Knowledge and Antibiotic Treatment in Children

Variable	Knowledge		p-value	OR
	Low	High		
	N (%)	N (%)		
Age (Years)				
18-30	15 (15.6)	13 (13.5)	0.013	1.476
31-50	14 (14.6)	38 (39.6)		
>50	6 (6.3)	10 (10.4)		
Sex				
Male	4 (4.2)	13 (13.5)	0.222	0.352
Female	31 (32.3)	48 (50.0)		
Occupation				
Employed	31 (32.3)	40 (41.7)	0.061	0.069
Unemployed	4 (4.2)	21 (21.8)		
Education				
Low (Primary-Junior High School)	27 (28.1)	4 (4.2)	0.000	2.152
Medium (Senior High School)	3 (3.1)	21 (21.9)		
Higher (University)	5 (5.2)	36 (37.5)		

Description:
N : Number of respondents
% : Percentage of respondents
OR : Odds ratio

Relationship Between Awareness and Respondents' Characteristics

Table 3. Relationship Between Awareness and Antibiotic Treatment in Children

Variable	Awareness		p-value	OR
	Low	High		
	N (%)	N (%)		
Age (Years)				
18-30	19 (19.8)	9 (9.4)	0.000	1.512
31-50	5 (5.2)	47 (49.0)		
>50	8 (8.3)	8 (8.3)		
Sex				
Male	7 (7.3)	10 (10.4)	0.450	0.114
Female	25 (26.0)	54 (56.3)		
Occupation				
Employed	25 (26.0)	46 (47.9)	0.511	0.398
Unemployed	7 (7.3)	18 (18.8)		
Education				
Low (Primary-Junior High School)	19 (19.8)	12 (12.5)	0.000	3.752
Medium (Senior High School)	6 (6.3)	18 (18.8)		
Higher (University)	7 (7.3)	34 (35.3)		

Description:
N : Number of respondents
% : Percentage of respondents
OR : Odds ratio

Relationship Between Practices and Respondents' Characteristics

Table 4. Relationship Between Parents' Practices and Antibiotic Treatment in Children

Variable	Parents' Practices		p-value	OR
	Poor	Good		
	N (%)	N (%)		
Age (Years)				
18-30	17 (17.7)	11 (11.5)	0.000	3.885
31-50	10 (10.4)	42 (43.8)		
>50	6 (6.3)	10 (10.3)		
Sex				
Male	4 (4.2)	13 (13.5)	0.299	0.663
Female	29 (30.2)	50 (52.1)		
Occupation				
Employed	29 (30.2)	42 (43.8)	0.024	1.276
Unemployed	4 (4.2)	21 (21.8)		
Education				
Low (Primary-Junior High School)	26 (27.1)	5 (5.2)	0.000	5.894
Medium (Senior High School)	4 (4.2)	20 (20.8)		
Higher (University)	3 (3.1)	38 (39.6)		

Description:
N : Number of respondents
% : Percentage of respondents
OR : Odds ratio

DISCUSSION

Respondents' Characteristics

Table 1 shows that the majority of respondents were at the age of 31-50 years old with 52 respondents (54.2%), while the lowest frequency was observed among respondents aged over 50 years old with 16 respondents (16.6%). This finding is consistent with previous research, which reported that among 573 respondents, the most common age group was over 31 years. Age also influences cognitive capacity and patterns of thinking, in which as age increases, cognitive abilities and thought processes develop further, thereby enhancing the acquisition of knowledge (18).

Based on **Table 1**, the majority of respondents were female with 79 respondents (82.3%). This is because the role of child carer is predominantly assumed by mothers rather than fathers, although fathers also play an important role. Mothers take care of children while simultaneously providing emotional support and affection. Meanwhile, fathers typically serve as the family's breadwinner and protector, ensuring financial stability and a sense of security for the children (9).

Several studies have not indicated that males or females inherently differ in cognitive knowledge levels. In practice, females are often observed to be more diligent, meticulous, and thorough when assigned tasks or carrying out activities. However, this does not necessarily imply that such traits correlate with superior knowledge or cognitive ability (18).

The occupational characteristics show the highest frequency among respondents who are employed, accounting for 71 individuals (74.0%). Employment, particularly in high-income positions or as socio-economic status rises, tends to enhance health-related efforts, including rational antibiotic use (19). Individuals with favourable socio-economic status (employment) are more likely to acquire better knowledge, awareness, and information regarding antibiotic use, which in turn can influence their attitudes and practices towards rational antibiotic use (20).

The respondents' educational characteristics show that the highest frequency was found among those with higher education levels, totalling 41 respondents (42.7%). Knowledge can influence awareness, attitudes, and sound judgement in making decisions regarding antibiotic use. The better one's knowledge, the more positive the resulting awareness and attitudes. Attitude is one of the determining factors in making decisions and taking action related to antibiotic use (18). Knowledge is

largely acquired through education, experience, media exposure, and the surrounding environment (21).

Overview of Parental Knowledge, Awareness, and Practices on Antibiotic Resistance in Children

Figure 1 shows that 35 respondents (36.5%) had low knowledge, while 61 respondents (63.5%) had high knowledge. In terms of awareness, 32 respondents (33.3%) had low awareness, while 64 respondents (66.7%) had high awareness. Furthermore, for practice characteristics, 63 respondents (65.6%) displayed good practices, while 33 respondents (34.4%) showed poor practices. These findings are consistent with a previous study conducted in Bangladesh, which reported that more than half of 205 respondents demonstrated good attitudes and practices towards antibiotic use, largely due to their higher education levels (22).

Similarly, a study conducted in Kemissie City, Ethiopia, involving 374 respondents found that the majority had high knowledge (171 respondents; 77%) and high awareness (73.1%). The study highlighted that greater knowledge significantly influences improved awareness and promotes rational antibiotic use. These results underscore the importance of continuous health education to enhance public behaviour concerning the proper use of antibiotics (15).

Distribution of Questionnaire Frequency

Parental Knowledge of Antibiotic Use in Children

Based on **Figure 2**, the distribution of questionnaire responses regarding parental knowledge of antibiotic use in children shows that the highest percentage was found in Question No. 1: “Antibiotics should be administered according to a doctor’s recommendation, even if the symptoms of the illness start to improve”. A total of 91 respondents (95%) answered correctly, while only 5 respondents (5%) answered incorrectly. This finding indicates that the majority of respondents understand that antibiotics must be used strictly according to a physician’s prescription and should not be taken arbitrarily. Antibiotics are classified as prescription-only medicines (*obat keras*), which, according to Government Regulation No. 51 of 2009 on Pharmaceutical Practice, may only be dispensed with a valid prescription and must be provided by a pharmacist. Therefore, antibiotic administration should always be based on a doctor’s recommendation, with the correct indication and dosage according to the patient’s condition. Additionally, pharmacists are required to provide proper information and education at the time of dispensing to ensure safe and rational antibiotic use (21, 22).

The question with the lowest percentage was Question No. 13: “Paracetamol is an example of an antibiotic”, with 34 respondents (35%) answering correctly and 62 respondents (65%) answering incorrectly. These results indicate that the majority of respondents did not understand that paracetamol is not an antibiotic. Based on brief interviews with several respondents, this misconception may have occurred because paracetamol is often prescribed together with antibiotics, as bacterial infections are commonly accompanied by fever. Consequently, many respondents assumed that paracetamol is also an antibiotic.

Previous studies have indicated that misconceptions regarding drug classification are still commonly found within the community, particularly among younger individuals and elderly groups who are accustomed to taking multiple medications simultaneously without adequate understanding of their functions. Therefore, continuous education about the distinction between antibiotics and other drugs, such as paracetamol, is crucial to prevent irrational antibiotic use and to reduce the incidence of antibiotic resistance in the community. Through such educational efforts, public knowledge can be enhanced, enabling individuals to be more discerning in their medication use, consuming antibiotics only as prescribed by a doctor, and avoiding misinformation regarding pharmaceuticals (25).

Parental Awareness Questionnaire on Children’s Antibiotic Treatment

Based on **Figure 3,** the frequency distribution of the parental awareness questionnaire regarding antibiotics in children shows that the question with the highest percentage was Question No. 8: “What do you think are the consequences of antibiotic resistance? 1. Decreased antibiotic activity; 2. The need for costly treatments; 3. Failure to recover from illness; 4. Increased intensity and duration of the disease”. A total of 74 respondents (77%) answered “yes”, while 22 respondents (23%) answered “no”. According to the results in the table, the majority of respondents were aware that improper use of antibiotics can lead to antibiotic resistance. Antibiotic resistance causes bacteria to become

unresponsive to the drugs meant to kill them, resulting in decreased effectiveness of antibiotics in treating infectious diseases in humans, animals, and plants. This condition increases morbidity and mortality rates, treatment duration and costs, and the risk of adverse effects due to the use of multiple or high-dose medications (24).

The question with the lowest percentage was Question No. 2: "I know what the term Antibiotic Resistance' means". A total of 36 respondents (38%) answered "yes", while 60 respondents (63%) answered "no". These results indicate that the majority of respondents did not fully understand the term *antibiotic resistance*. Based on brief interviews, it was found that most respondents were not familiar with the term itself, they only recognised the negative consequences that could occur when antibiotics are used without a doctor's prescription (inappropriate use of antibiotics).

This phenomenon indicates that public knowledge regarding the term and concept of antibiotic resistance remains low, even though people are aware that using antibiotics without a doctor's prescription is harmful. This lack of understanding may be due to the limited availability of health education specifically addressing antibiotic resistance, both in schools and within the general community. In fact, targeted and collaborative educational efforts have been proven to enhance understanding and awareness of the proper use of antibiotics, particularly among younger generations (26).

Parental Practices Questionnaire on Children's Antibiotic Treatment

Based on **Figure 4,** the frequency distribution of the parental practice questionnaire regarding antibiotic use in children shows that the question with the highest percentage was Question No. 5: "I determine the dosage or amount of antibiotics for my child's self-medication after reading the leaflet or information on the drug packaging". A total of 50 respondents (52%) answered "Yes", while 46 respondents (48%) answered "No". These results indicate that the majority of respondents read the instructions on the packaging before administering the antibiotics. Pharmaceutical manufacturers include informational leaflets inside drug packaging as a simple and practical guide that contains instructions and warnings on proper drug use to enhance public understanding of the medication (27).

The question with the lowest percentage was Question No. 1: "I can treat my child with antibiotics without consulting a doctor or pharmacist", with 23 respondents (24%) answering "Yes" and 73 respondents (76%) answering "No". Based on the brief interviews, it was found that the majority of respondents administered antibiotics to their children only after consulting a doctor, aiming to minimise the risk of antibiotic resistance in their children.

Based on the results of the study, the majority of parents demonstrated relatively good behaviour in the practice of antibiotic use for their children, particularly in reading the instructions provided on the packaging before administering antibiotics independently. This indicates an increasing awareness of the importance of the information provided by pharmaceutical manufacturers to ensure proper and safe medication use. Education through brochures and drug packaging has proven effective in enhancing public understanding of the correct use of antibiotics, thereby reducing the risk of misuse and antibiotic resistance (28). Furthermore, the low percentage of parents who administer antibiotics without consulting a doctor reflects a responsible attitude toward their children's treatment. Consulting healthcare professionals, such as doctors, is a key factor in preventing inappropriate antibiotic use and resistance. Continuous education and health promotion are still necessary to further strengthen these practices within the community (29).

Pharmacists play a crucial role in providing education and information related to the use of antibiotics and efforts to prevent bacterial resistance by ensuring their use is appropriate and rational. They hold the responsibility to explain to patients the correct dosage, duration of treatment, and the importance of completing antibiotic therapy to prevent the emergence of resistance (30). In addition, pharmacists are also responsible for controlling the distribution of antibiotics to ensure they are not sold freely without a doctor's prescription, thereby helping to reduce drug misuse within the community (31). Through education and counselling, pharmacists contribute to improving public understanding of the risks of antibiotic resistance and the importance of using medicines wisely (30). This role is particularly vital given the high rate of inappropriate antibiotic use, which can accelerate the development of resistance, positioning pharmacists as the frontline in antimicrobial resistance control (31).

Relationship Between Knowledge and Respondent Characteristics

Table 2 shows that the variables of age and education have an influence on respondents' knowledge regarding the risk of antibiotic resistance in children in Sampang, with a p-value of 0.013<0.05 (39.6%) and a p-value of 0.000<0,05 (37.5%). This finding is consistent with previous research on the understanding of Indonesian society regarding antibiotic use, which revealed that the higher a person's level of education particularly at the undergraduate level, the better their knowledge about antibiotic use (32). This result also aligns with developmental theory, which states that as individuals age, changes also occur in psychological and mental aspects. At this stage, thinking ability becomes more mature and rational, enabling individuals to solve complex problems through abstract, logical, and critical thinking, which contributes to increased knowledge (33).

Based on the results of the study, the obtained Odds Ratio (OR) value of 1.476 for the age variable indicates that older parents are approximately 1.476 times more likely to possess a higher level of knowledge compared to younger age groups. This finding is consistent with a study conducted in Tanzania, which reported that respondents aged over 40 years old were more likely to have a better understanding of antibiotic use than younger groups, with an OR of 1.55 (95% CI: 1.20-2.00). This may be attributed to greater experience in accessing healthcare services and increased exposure to health information with advancing age (34). The OR value of 0.352 for the gender variable indicates that men are less likely to have a high level of knowledge regarding antibiotic resistance compared to women. This finding aligns with previous research conducted in Italy, which showed that women tend to have higher knowledge scores related to antibiotics, although gender differences are not always statistically significant. Such differences may be associated with the role of women, particularly mothers, who are more frequently involved in making healthcare decisions for their children (35).

Furthermore, the OR value of 0.069 for the employment variable indicates that respondents who were employed had a much lower likelihood of possessing a high level of knowledge compared with those who were unemployed. This finding differs slightly from a study conducted in Bangladesh, which reported that employment status was positively associated with the level of knowledge and awareness regarding antibiotics (OR = 1.42; 95% CI: 1.10-1.90). This discrepancy may be influenced by contextual factors, where working parents often have limited time to access health information compared to those who do not work (36). For the education variable, the OR value of 2.152 suggests that parents with a higher level of education are more than twice as likely to have a high level of knowledge compared to parents with lower educational attainment. This finding is consistent with a study conducted in Jordan, which reported that parents with postgraduate degrees had an OR = 1.79 (95% CI: 1.01-3.18) for better antibiotic knowledge compared to those with only secondary education or less. This indicates that higher education is consistently associated with better knowledge regarding antibiotics (37).

The inappropriate use of antibiotics, including non-compliance with prescribed treatment regimens, is a major cause of antimicrobial resistance, which leads to increased morbidity, mortality, and higher healthcare costs and treatment duration (38). In addition, AMR results in infections that are more difficult to treat and promotes the emergence of Multidrug-Resistant Organisms (MDROs), which prolong treatment duration and reduce therapeutic effectiveness. Therefore, improving knowledge which is influenced by both age and educational level is crucial in promoting the wise and rational use of antibiotics, ultimately helping to curb the growing rate of antibiotic resistance within the community (39).

Relationship between Awareness and Respondent Characteristics

Table 3 shows that the variables of age and education influence respondents' awareness of the risk of antibiotic resistance in children in Sampang, with p-values of 0.000<0.05 and percentages of 49.0% and 35.3%, respectively. This finding is consistent with a previous study on knowledge, attitude, and practice regarding antibiotic use among university students in Bangladesh, which reported that a person's attitude is influenced by the knowledge gained through education. Respondents with a background in biological sciences demonstrated better knowledge, highlighting the importance of an appropriate curriculum in developing knowledge that fosters a positive attitude towards antibiotic use (22). Furthermore, education influences both knowledge and awareness, which in turn affect one's perspective and decision-making in the rational use of antibiotics (17, 27).

A study conducted at Kendari General Hospital also reported that age and education significantly influence respondents' awareness of antibiotic resistance risks through enhanced knowledge gained

with increasing age and educational attainment. This is because greater maturity is often accompanied by improved cognitive capacity, enabling individuals to understand complex consequences such as antibiotic resistance, while formal education provides broader access to accurate information and understanding regarding the proper use of antibiotics (40). Other studies further support that educational level plays a crucial role in shaping appropriate attitudes and behaviours towards antibiotic use, suggesting that awareness of antibiotic resistance risks increases in line with the knowledge acquired through education (41).

Based on the study results, the OR = 1.512 for the age variable indicates that older parents have approximately 1.5 times higher odds of having greater awareness regarding antibiotic resistance compared to younger parents. This finding is consistent with a study conducted in Tanzania, which reported that respondents aged over 40 years were more likely to have better understanding and awareness about antibiotic use than younger groups, with OR = 1.55 (95% CI: 1.20-2.00). This is likely because as age increases, experience in accessing healthcare services and exposure to health information also improve (34). The OR = 0.114 for the gender variable shows that men have a lower likelihood of possessing high awareness of antibiotic resistance compared to women. This difference can be attributed to the role of women, particularly mothers, who are more frequently involved in health-related decision-making for their children (35).

Furthermore, the OR = 0.398 for the occupation variable indicates that working respondents have lower odds of possessing high awareness compared to those who are not employed. This may be influenced by the fact that working parents often have limited time to access health-related information compared to non-working parents (36). For the education variable, the OR = 3.752 suggests that parents with higher education levels are nearly four times more likely to have greater awareness of antibiotic resistance compared to those with lower education levels. This finding reinforces that higher education is consistently associated with improved awareness and understanding of antibiotic resistance (37).

Relationship Between Practice and Respondent Characteristics

Table 4 shows that the variables of age, occupation, and education influence respondents' practices regarding the risk of antibiotic resistance in children in Sampang District, with p-values of 0.000<0.05; 0.024<0.05; and 0.000<0.05, respectively. The highest percentages were observed in the age and occupation variables (43.8%), followed by education (39.6%). This finding is consistent with a previous study on knowledge, attitudes, and practices regarding antibiotic use among university students in Bangladesh, which revealed that better knowledge and attitudes positively impact antibiotic use practices. Students with higher levels of knowledge and awareness demonstrated more appropriate and rational practices in antibiotic consumption (42).

A similar finding is presented in **Table 4**, which describes the relationship between parents' practices and individual age, showing that parental practices in antibiotic treatment are influenced by age, occupation, and education. As individuals grow older, their cognitive capacity and reasoning skills develop, ultimately enhancing their knowledge and ability to make more rational decisions regarding antibiotic use (43). Furthermore, occupation and educational level also play significant roles, as working parents and those with higher educational attainment tend to demonstrate better practices in administering antibiotics to their children (42).

Based on the findings, the OR value of 3.885 for the age variable indicates that older parents are nearly four times more likely to demonstrate good practices in antibiotic use compared with younger age groups. This finding is consistent with a national survey in Indonesia, which revealed that older individuals tend to exhibit more appropriate antibiotic use behaviours than their younger counterparts (44). The OR value of 0.663 for the gender variable suggests that men are less likely to have good practices compared with women. This result aligns with a study conducted in Malang, Indonesia, which reported that women demonstrated better practices regarding antibiotic use than men (45).

Furthermore, the OR value of 1.276 for the employment variable indicates that employed respondents are more likely to demonstrate good practices compared with those who are unemployed. This finding is consistent with a study conducted in Malaysia, which reported that employment status is one of the factors associated with antibiotic use (46). For the education variable, the OR value of 5.894 suggests that parents with higher education levels are nearly six times more likely to exhibit good practices than those with lower education levels. This result aligns with research conducted in

Indonesia, which found a strong association between education level and rational antibiotic use practices, the higher the education, the better the practices observed. These findings reaffirm that education serves as a key determinant in shaping appropriate antibiotic use behaviours (47).

Although this study provides valuable insights into the knowledge, awareness, and practices related to antibiotic use and antibiotic resistance in Sampang, Cilacap Regency, several limitations should be acknowledged. As the study employed a cross-sectional design, it restricts causal interpretation and long-term analysis. Moreover, the sample may not fully represent the general population, as it primarily consisted of rural residents and individuals with higher education levels. To address these limitations, future research should consider adopting a longitudinal design, incorporating more objective measures, and utilising more representative sampling techniques to strengthen and broaden the current findings.

CONCLUSION

The findings of this study indicate that parents in Sampang, Cilacap Regency possess a high level of knowledge and awareness, as well as good practices related to antibiotic resistance in children. Furthermore, age and education were found to influence knowledge, awareness, and practices regarding antibiotic resistance. Nevertheless, education on antibiotics remains essential to further enhance community understanding, awareness, and practices concerning antibiotic resistance to achieve better health outcomes. Future research should focus on developing effective educational strategies and assessing their impact on reducing the risk of antibiotic resistance in children.

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