ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7309-7316 (2026)
©Biomedical Informatics (2026)

BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300227309

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

Declaration on Publication Ethics:
The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at https://publicationethics.org/. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:
The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:
This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:
Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:
Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/ Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Vini Mehta
E-mail: vmehta@statsense.in
Citation: Nagaraj *et al.* Bioinformation 22(10): 7309-7316 (2026)

Knowledge, attitude and practice of antibiotic use and resistance among children in Saudi Arabia

Anupama Nagaraj[1,*], Mohammad Asim[2], Hina Kausher[1], Kawther Ahmed Alzwiri[1] & Rawan Bassam Hijazi[1]

[1]Department of Applied Medical Sciences, Riyadh Elm University, Kingdom of Saudi Arabia; [2]Department of Basic Sciences, Riyadh Elm University, Kingdom of Saudi Arabia; *Corresponding author

Affiliation URL:
https://www.riyadh.edu.sa

Author contact:
Anupama Nagaraj - E-mail: anupama.nagaraj@riyadh.edu.sa
Mohammad Asim - E-mail: muhammadasim@riyadh.edu.sa

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7309-7316 (2026)
©Biomedical Informatics (2026)

Hina Kausher - E-mail: hina.kausher@riyadh.edu.sa
Kawther Ahmed Alzwiri - E-mail: kawther.a.alzwairi2020@student.riyadh.edu.sa
Rawan Bassam Hijazi - E-mail: rawan.b.hijazi2020@student.riyadh.edu.sa

Abstract:
Antibiotic misuse and overuse contribute substantially to antimicrobial resistance, with parents playing an important role in antibiotic use and adherence among children. Therefore, it is of interest to assess the knowledge, attitudes and practices regarding antibiotic use and resistance among 348 parents or legal guardians of children aged 0-12 years across Saudi Arabia using a pre-validated structured questionnaire and stratified sampling. Most participants were women (78.7%) and aged 21-40 years (67.8%); 62.9% knew that antibiotics treat bacterial infections, 75.3% understood the consequences of misuse, 59.8% showed good knowledge, 61.8% had favourable attitudes and 61.2% showed good practices, although 40.8% reported antibiotic use without a prescription ($p<0.05$). Higher education and income were significantly associated with better knowledge, attitudes and practices. These findings advance knowledge by highlighting persistent gaps between antibiotic-related knowledge and practices and supporting targeted education and stronger antibiotic stewardship measures to combat antimicrobial resistance.

Keywords: Antimicrobial misuse, antibiotic resistance, knowledge attitude practice, paediatric antibiotic use, public health, Saudi Arabia

Background:
Antibiotics are a class of drugs that have transformed modern medicine and are frequently used to treat bacterial infections **[1].** However, the overuse, abuse and misuse of antibiotics have resulted in treatment failures, the growth of antibiotic-resistant bacteria and higher health care costs-all of which represent a serious threat to public health **[2].** One of the biggest issues facing worldwide public health in the twenty-first century is antibiotic resistance. Misuse of antibiotics also has negative financial and health effects on people. The rise of AMR (Antimicrobial Resistance), longer hospital admissions, morbidity, mortality and higher healthcare costs for patients due to increased antibiotic use are among the negative outcomes **[2]**. Antibiotic resistance is also thought to be mostly caused by incorrect antibiotic prescriptions **[3].** The development of antibiotic resistance in children is thought to be largely caused by parents and paediatricians. When determining whether to prescribe an antibiotic, parents' expectations and beliefs play a crucial role. It is discovered that when parents are terrified of an acute illness, they frequently attend paediatric wards for the illnesses, which leads to the unnecessary use of antibiotics **[4]**. As a result, a lot of research has looked into the causes of antibiotic misuse. These variables include knowledge, attitudes and practices about the use of antibiotics, behaviours, satisfaction with patient care, the patient-physician relationship and patient experiences with antibiotic usage **[5]**. One of the most important factors in the appropriate use of antibiotics and, thus, lowering the incidence of increasing resistance is adequate public awareness and attitude towards their usage **[6]**. However, doctors are under tremendous pressure to meet patients' expectations, which is thought to play a major role in their recommendation to treat illnesses with antibiotics **[6]**. As a result, parents' knowledge, behaviour and mind-set regarding the use of antibiotics to treat these diseases in their kids are crucial. Numerous studies on the abuse of antibiotics and purchasing them without a doctor's prescription have been conducted in Saudi Arabia **[7]**. The degree of antibacterial agent storage and waste in Saudi Arabian households, the acquisition and use of antibiotics without a prescription and the patterns of antimicrobial recommendation among hospitalised patients have all been investigated in these studies **[8].** Nevertheless, few or none of these studies have evaluated parents' knowledge, attitude and practice of children aged 0-12 years regarding the use of antibiotics and resistance in kids. As a result, this is a novel study in Saudi Arabia to investigate the parental KAP in relation to paediatric antibiotic use **[8]**. Therefore, it is of interest to anticipate that the current experiment would be crucial in providing a framework for developing tactics to be employed in order to inform or educate the local health authorities.

Materials and Methods:

Study design and setting:
The present cross-sectional study was conducted among parents or legal guardians of children aged 0-12 years in Saudi Arabia over a study period of one year. Participation was voluntary and written informed consent was obtained from all participants. Confidentiality was ensured by anonymizing responses and participants were informed of their right to withdraw from the study at any time without any repercussions.

Participants:
A stratified sampling technique was employed in Saudi Arabian regions (*e.g.,* Central, Western, Eastern and Southern) to ensure geographical diversity. The target sample size was 348 parents, based on a power analysis to detect significant differences with a confidence level of 95% and a margin of error of 5%.

Statistical analysis:
SPSS version 25.0 was the statistical analysis program used for the quantitative data analysis. Descriptive statistics were calculated on the demographics and the KAP variables and inferential statistics (*e.g.,* chi-square tests and independent t-tests) were used to examine the relationship between the KAP levels and demographic variables. A p-value of <0.05 was considered to be statistically significant.

Questionnaire:
A pre-validated structured questionnaire was used to assess knowledge, attitudes and practices (KAP) regarding antibiotic use and resistance **(Table 1)**. The questionnaire consisted of the following sections:

[1] **Demographic information:** Age, gender, education level and socioeconomic status of the parents.
[2] **Knowledge:** Questions assessed awareness of antibiotic indications, potential side effects and understanding of antibiotic resistance. True/false and multiple-choice questions will be utilized.
[3] **Attitudes:** Items that measured parents' beliefs about antibiotic necessity, safety and the seriousness of antibiotic resistance using a Likert scale.
[4] **Practices:** Questions explored antibiotic use behaviors, including self-medication, adherence to medical advice and response to prescription practices.

Inclusion criteria:
[1] Parents/guardians of a child aged between 0 and 12 at the time of data collection.
[2] Parents residing in Saudi Arabia at the time of data collection.
[3] Parents who are able to read and write neither Arabic nor English.
[4] Parents who have provided written consent to participate in this study.

Exclusion criteria:
[1] Parents of children older than 12 years old (no younger child in the specified age group).
[2] Healthcare professionals (*e.g.,* physicians, pharmacists, nurses) in order to limit the potential for bias through knowledge from their professions.
[3] Any subject that did not agree to participate (*i.e.,* did not provide consent) or withdrew from the study prior to completing the study.
[4] An incomplete response; inconsistent response; or duplicate response.
[5] Any subject that did not understand the questionnaire (*i.e.,* due to language barrier or cognitive limitation).

Ethical approval:
Ethical approval was obtained from the Institutional Review Board prior to the commencement of the study.

Results:
Table 2 shows the demographic profile of parents. Most of the people who answered (67.8%) were between the ages of 21 and 40. Only 16.4% of them were between the ages of 41 and 50, 13.8% were under 20 and 2.0% were over 50. The sample was mostly female (78.7%) when it came to gender. 19.8% of the people were men and only 1.4% of the people didn't want to disclose the gender. Most of the people who took part in the study had a bachelor's degree (62.6%), followed by secondary education (27.5%) and finally, postgraduates (9.2%). Only a small number (0.5%) had a primary school education. More than half of the people who answered (53.2%) said they made less than 5000 SAR a month. The other participants were split into three groups: 5000-10,000 SAR (22.1%), 10,001-15,000 SAR (9.5%) and above 15,000 SAR (15.2%). **Table 3** assesses the extent of parents' knowledge regarding antibiotic use and resistance. About 62.9% of the people who took part correctly identified antibiotics as being effective against bacterial infections. On the other hand, a large 37.1% did not understand this correctly. A very high percentage (83.6%) of respondents believed that people should always complete their course of antibiotics as prescribed, although a small proportion (16.4%) were unaware of this fundamental principle. Most respondents were aware of the consequences of inappropriate use of antibiotics. About three-quarters (75.3%) of participants were aware that misusing antibiotics can lead to antibiotic resistance and treatment failure. However, almost one-fourth (24.7%) of participants either didn't know how to answer this question or provided the wrong answer. The majority (52%) received the information from a healthcare provider; secondarily, they received their information from the internet (26.1%); family and/or friends (14.1%); or from an educational program (7.8%). **Table 4** shows parents' attitudes toward antibiotic use and antibiotic resistance. Of those responding to the survey, 60.9% indicated that they are very concerned about the problem of antibiotic resistance. A further 23.9% indicated moderate concern and 15.2% indicated low concern. 51.1% of respondents were in agreement that antibiotics are not required for every type of infection; however, 32.2% of respondents thought that all infections require antibiotics and 16.7% were unsure. These numbers suggest that there continues to be a lack of proper understanding among some individuals. 69.5% of respondents indicated that they trust their physician when it comes to deciding on the appropriate medication for them, indicating a high level of trust in medical practitioners. The remaining responses were as follows: 19.5% of participants did not express either agreement or disagreement with trusting their physician regarding medication and 10.9% of participants expressed a lack of trust in the physician's judgment on the appropriate medication. **Table 5** shows practices of parents toward the use of antibiotics with their children. A troubling discovery is that 40.8% of parents said they gave their children antibiotics without a prescription. On the other hand, 59.2% followed prescription-based use. Most people (60.9%) got their antibiotics from a doctor, but a large number (22.4%) got them over the counter or from friends and family (11.8%). When their child was sick, 66.4% of parents went to the doctor first. However, 14.1% chose over-the-counter antibiotics, while others used home remedies (12.6%) or waited and watched (6.9%). This shows that people made different choices. 63.5% of people who took antibiotics always finished the prescribed course, 19.8% did so often and 16.7% did so rarely or never. **Figure 1** shows the overall KAP score of parents. In the knowledge domain, 59.8% exhibited good knowledge, 24.1% displayed moderate knowledge and 16.1% revealed poor knowledge. Attitudinal assessment indicated that 61.8% of participants possessed a

positive attitude, while 22.4% maintained a neutral stance and 15.8% displayed negative attitudes. In terms of practice, 61.2% of parents showed good practices, 22.1% showed moderate practices and 16.7% showed poor practices. **Table 6** illustrates the association between KAP and demographic variables. There were strong links between knowledge levels and age ($p = 0.043$), education ($p < 0.001$) and income ($p = 0.021$). Older people, people with more education and people with more money were more likely to have more knowledge. Gender, however, did not exhibit a statistically significant correlation ($p = 0.074$). Attitude was significantly correlated with education ($p = 0.006$) and income ($p = 0.044$), suggesting that individuals with higher education and income levels generally possess more favourable attitudes towards antibiotic utilisation. While age and gender exhibited trends, these correlations lacked statistical significance. Education ($p = 0.015$) and income ($p = 0.048$) had a big effect on practice patterns, which means that socioeconomic factors are very important in determining how people should use antibiotics. There were no statistically significant relationships found between age or gender.

Table 1: Questionnaire

Section	Question	Response Options
Demographic Information	Age	Under 20; 21-35; 41-50; Over 50
	Gender	Male; Female; Prefer not to say
	Highest level of education	No formal education; Primary education; Secondary education; Bachelor's degree; Postgraduate degree
	Monthly income	<5,000 SAR; 5,000-10,000 SAR; 10,001-15,000 SAR; >15,000 SAR
Knowledge	What are antibiotics used for? (Select all that apply)	Bacterial infections; Viral infections; Fungal infections; Other (specify)
	Antibiotic course should be followed as prescribed by the healthcare provider	Always; Not always
	Which of the following can result from misuse of antibiotics? (Select all that apply)	Antibiotic resistance; Longer recovery time; More severe infections; No effect
	Source of information about antibiotics	Healthcare provider; Educational programs; Internet; Family and friends
Attitude	Level of concern about antibiotic resistance (Likert scale)	1 = Not at all concerned; 2; 3; 4; 5 = Very concerned
	Antibiotics are necessary for treating all infections in children	Yes; No; Unsure
	Trust in doctor's judgment for prescribing antibiotics (Likert scale)	1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree
Practice	Ever given antibiotics without prescription	Yes; No
	How antibiotics are obtained (Select all that apply)	Doctor's prescription; Over-the-counter; Borrowed from friends/family; Other (specify)
	First course of action when child is sick	Consult a doctor; Buy antibiotics OTC; Home remedies; Wait and observe
	Frequency of completing full antibiotic course	Always; Often; Rarely; Never

Table 2: Demographic data of parents

Variable	Category	N (%)
Age	21-40 years	236 (67.8%)
	41-50 years	57 (16.4%)
	<20 years	48 (13.8%)
	>50 years	7 (2.0%)
Gender	Female	274 (78.7%)
	Male	69 (19.8%)
	Prefer not to say	5 (1.4%)
Education	Bachelor's degree	218 (62.6%)
	Secondary education	96 (27.5%)
	Postgraduate degree	32 (9.2%)
	Primary education	2 (0.5%)
Monthly Income	<5000 SAR	185 (53.2%)
	5000-10,000 SAR	77 (22.1%)
	10,001-15,000 SAR	33 (9.5%)
	>15,000 SAR	53 (15.2%)

Table 3: Assessment of knowledge questions among parents

Variable	Response	N (%)
Correct indication (bacterial infections)	Yes	219 (62.9%)
	Incorrect	129 (37.1%)
Course should be followed as prescribed	Always	291 (83.6%)
	Not always	57 (16.4%)
Aware of consequences of misuse	Yes	262 (75.3%)
	No/Incorrect	86 (24.7%)
Source of information	Healthcare provider	181 (52.0%)
	Internet	91 (26.1%)
	Family/Friends	49 (14.1%)
	Educational programs	27 (7.8%)

Table 4: Assessment of attitude questions among parents

Variable	Response	N (%)
Concern about antibiotic resistance	High (4-5)	212 (60.9%)
	Moderate (3)	83 (23.9%)
	Low (1-2)	53 (15.2%)
Antibiotics necessary for all infections	Yes	112 (32.2%)
	No	178 (51.1%)
	Unsure	58 (16.7%)
Trust in doctor's prescription	Agree/Strongly agree	242 (69.5%)
	Neutral	68 (19.5%)
	Disagree	38 (10.9%)

Table 5: Assessment of practice questions among parents

Variable	Response	N (%)
Antibiotic use without prescription	Yes	142 (40.8%)
	No	206 (59.2%)
Source of antibiotics	Doctor's prescription	212 (60.9%)
	Over-the-counter	78 (22.4%)
	Friends/Family	41 (11.8%)
	Other	17 (4.9%)
First action when child is sick	Consult doctor	231 (66.4%)
	Buy OTC antibiotics	49 (14.1%)
	Home remedies	44 (12.6%)
	Wait and observe	24 (6.9%)
Completion of antibiotic course	Always	221 (63.5%)
	Often	69 (19.8%)
	Rarely/Never	58 (16.7%)

Table 6: Association of KAP with demographic data of parents

Variable	Category	Good Knowledge n (%)	Poor Knowledge n (%)	χ^2	p-value
Knowledge					
Age	21-40 yrs (n=236)	162 (68.6%)	74 (31.4%)	8.12	0.043*
	41-50 yrs (n=57)	32 (56.1%)	25 (43.9%)		
	<20 yrs (n=48)	19 (39.6%)	29 (60.4%)		
	>50 yrs (n=7)	6 (85.7%)	1 (14.3%)		
Gender	Female (n=274)	180 (65.7%)	94 (34.3%)	5.21	0.074
	Male (n=69)	36 (52.2%)	33 (47.8%)		
	Prefer not (n=5)	3 (60.0%)	2 (40.0%)		
Education	Bachelor (n=218)	150 (68.8%)	68 (31.2%)	18.64	<0.001*
	Secondary (n=96)	50 (52.1%)	46 (47.9%)		
	Postgraduate (n=32)	28 (87.5%)	4 (12.5%)		
	Primary (n=2)	1 (50.0%)	1 (50.0%)		
Income	<5000 (n=185)	102 (55.1%)	83 (44.9%)	9.77	0.021*
	5000-10k (n=77)	52 (67.5%)	25 (32.5%)		
	10k-15k (n=33)	25 (75.8%)	8 (24.2%)		
	>15k (n=53)	40 (75.5%)	13 (24.5%)		
Attitude					
Age	21-40 yrs	152 (64.4%)	84 (35.6%)	7.54	0.056
	41-50 yrs	35 (61.4%)	22 (38.6%)		
	<20 yrs	22 (45.8%)	26 (54.2%)		
	>50 yrs	6 (85.7%)	1 (14.3%)		
Gender	Female	175 (63.9%)	99 (36.1%)	4.92	0.085
	Male	37 (53.6%)	32 (46.4%)		
Education	Bachelor	150 (68.8%)	68 (31.2%)	12.31	0.006*
	Secondary	52 (54.2%)	44 (45.8%)		
	Postgraduate	26 (81.3%)	6 (18.7%)		
Income	<5000	108 (58.4%)	77 (41.6%)	8.11	0.044*
	5000-10k	50 (64.9%)	27 (35.1%)		
	10k-15k	24 (72.7%)	9 (27.3%)		
	>15k	38 (71.7%)	15 (28.3%)		
Practice					
Age	21-40 yrs	150 (63.6%)	86 (36.4%)	6.02	0.110
	41-50 yrs	34 (59.6%)	23 (40.4%)		
	<20 yrs	23 (47.9%)	25 (52.1%)		
	>50 yrs	6 (85.7%)	1 (14.3%)		
Gender	Female	170 (62.0%)	104 (38.0%)	3.88	0.143
	Male	36 (52.2%)	33 (47.8%)		
Education	Bachelor	148 (67.9%)	70 (32.1%)	10.45	0.015*
	Secondary	50 (52.1%)	46 (47.9%)		
	Postgraduate	25 (78.1%)	7 (21.9%)		
Income	<5000	105 (56.8%)	80 (43.2%)	7.92	0.048*

5000-10k	49 (63.6%)	28 (36.4%)
10k-15k	23 (69.7%)	10 (30.3%)
>15k	36 (67.9%)	17 (32.1%)

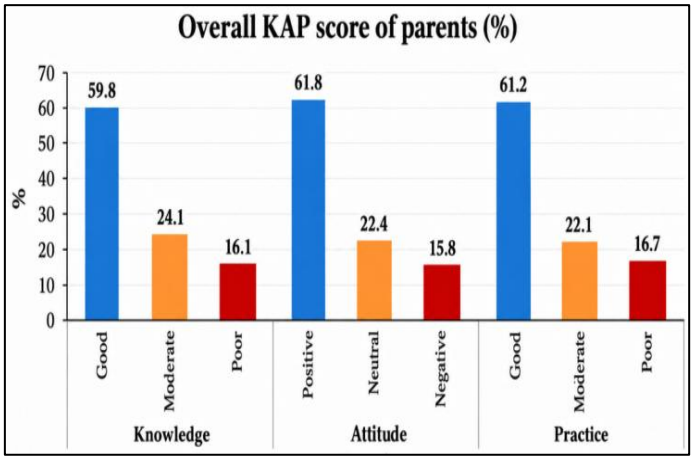


Figure 1: Distribution of knowledge, attitude and practice (KAP) scores among parents

Discussion:

Antibiotic resistance is a global problem that is made worse by the increasing prevalence of improper antibiotic usage in both medical settings and the general public. *Escherichia coli* and extended-spectrum *Klebsiella pneumoniae* have become more common in the Kingdom of Saudi Arabia **[9]**. This place acts as a hub for antibiotic resistance due to its location in the Middle East. Along with economic, health systems and environmental factors, the interplay of knowledge, expectations and interactions between healthcare providers and patients influences the usage of antibiotics **[10]**. As a result, it's critical to assess the knowledge, attitudes and practices (KAP) of parents of children, aged 0-12 years on antibiotic use, misuse and resistance. Antibiotics are effective against bacterial illnesses, according to approximately 62.9% of participants. Our study found a greater degree of knowledge compared with the findings published by El Zowalaty *et al.* in 2016, in which reported awareness of antibiotic use was 48% **[11].** However, findings from Saudi Arabia demonstrate considerable variation in antibiotic-related knowledge across population groups. Alkhalifah *et al.* reported that only 43.9% of participants attending a primary healthcare centre in Riyadh had adequate knowledge, despite a relatively favourable attitude score of 71.7% **[12].** Similarly, Alkhuraisi *et al.* reported that although 76.5% of participants were aware of antibiotic resistance, only 24.2% correctly identified its causes **[13].** These findings suggest that awareness of antibiotic resistance does not necessarily indicate a comprehensive understanding of its causes or prevention. Differences in the study populations, questionnaire items and scoring systems may explain the variations between studies. People were very aware of the potential consequences of using antibiotics improperly. Approximately 75.3% were aware that treatment failure and resistance could result from inappropriate antibiotic use. In a study conducted by Alnasser *et al.*, 74.9% of participants understood that failure to complete the recommended antibiotic course might result in antibiotic resistance **[14].** Nevertheless, contrary findings have been reported among university students in Saudi Arabia. Albadrani *et al.* found that 46% of undergraduate students incorrectly believed that antibiotics could treat viral infections, while 53% mistakenly believed that viruses could develop antibiotic resistance **[15].** Bawazir *et al.* also reported that 40.9% of non-medical university students had insufficient knowledge regarding antibiotics and resistance **[16].** These findings highlight the persistence of important misconceptions despite increasing public awareness. Therefore, educational interventions should explain the distinction between bacterial and viral infections and clarify how inappropriate antibiotic use contributes to resistance. Information came primarily from healthcare providers (52.0%), followed by the internet, friends and family and educational programmes in our study. This finding is consistent with Bawazir *et al.*, who identified healthcare professionals, particularly doctors, as the primary source of antibiotic-related information among non-medical university students in Riyadh **[16].** Alkhalifah *et al.* also recommended physician counselling, educational sessions and informational materials in primary healthcare settings to improve public awareness **[12].** However, reliance on informal sources, including the internet and family members, may expose parents to inaccurate information. Clear and consistent communication from healthcare professionals is therefore essential to improve parental understanding of antibiotic use and resistance. In our study, the majority of parents indicated concern about antibiotic resistance and demonstrated faith in doctors' prescribing decisions, according to the attitude evaluation. This positive outlook is promising because it shows openness to expert advice and public health messaging. Agarwal *et al.* revealed that 83% of parents always followed their paediatrician's instructions regarding the course of antibiotics **[17].** The findings were similar to those of research conducted in Malaysia, where 71.1% of parents reported taking antibiotics as directed by their physicians **[18].** However, favourable attitudes do not necessarily correspond to adequate knowledge or consistently appropriate practices. Alkhalifah *et al.* reported a relatively high attitude score of 71.7%, whereas the knowledge score was only 43.9% **[12].** This discrepancy suggests that parents may trust healthcare professionals while still lacking sufficient knowledge about the indications and appropriate use of antibiotics. Consequently, counselling should address both the importance of following medical advice and the reasons antibiotics are or are not indicated for particular illnesses. A portion of participants were unsure and roughly one-third thought that antibiotics were required for all infections. Similar to our study, Agarwal *et al.* **[17]** found that 45.9% of parents believed antibiotics could be used for any microbial infection. This may be attributed to the fact that doctors sometimes use the general term "germs" when explaining infections rather than

specifically distinguishing bacteria from viruses. As mentioned by Al Hashmi *et al*., people may not understand the difference between bacteria and viruses and may therefore believe antibiotics are effective against both **[18].** Evidence from the recent Saudi studies further supports this concern. Albadrani *et al.* found that 49% of undergraduate students incorrectly believed antibiotics were effective against viral infections, while 23% were uncertain about their effectiveness against bacterial infections **[15].** These results demonstrate that misconceptions about antibiotic indications persist even among university students. Therefore, educational messages should explicitly clarify that antibiotics are effective against susceptible bacterial infections but do not treat viral illnesses such as the common cold. A significant number of parents indicated that they administered antibiotics without a prescription and a considerable percentage acquired antibiotics through over-the-counter means or informal channels. Although most parents reported taking their sick children to a doctor, some relied on self-medication, home remedies or delayed care. These practices could lead to inappropriate antibiotic use or delayed treatment. In a previous study, 14.8% of parents had given their child antibiotics from a previous prescription without first consulting a physician **[17].** A study conducted in a developing country revealed that people with a medical background had a greater rate of self-medication **[19].** Comparable concerns were reported by Shamshu *et al.* in a study of 200 parents in India, in which the majority admitted to self-administration of antibiotics. Furthermore, 42.3% of parents believed that antibiotics were always necessary for acute respiratory infections **[20].** These findings support the need to address self-medication, the reuse of previously prescribed antibiotics and expectations for antibiotic treatment during childhood illnesses. In contrast, Alkhuraisi *et al.* reported that 68.8% of participants obtained antibiotics through a doctor's prescription and 68.9% reported stopping antibiotics only after completing the course **[13].** Bawazir *et al.* also reported responsible antibiotic practices among 60.6% of university students **[16].** These comparatively favourable findings indicate that antibiotic practices differ across populations and that inappropriate practices should not be assumed to occur uniformly. Differences in participant characteristics, healthcare access, study methodology and definitions of appropriate practices may partly explain these contrasting results. In the present study, parents with higher educational attainment and income showed better knowledge, more positive attitudes and more appropriate practices. Gender and age did not show consistent statistically significant associations with KAP outcomes. This was similar to a study conducted in Jordan, where no significant association was discovered between gender and KAP [**21].** There was also a significant association between educational level, antibiotic-use habits and knowledge. It was discovered that individuals with less education were less knowledgeable about antibiotics and more likely to misuse them **[22]**. This highlights the necessity of concentrating information campaigns and other interventions on those with lower educational attainment. This is also similar to a study conducted in Indonesia, which indicated that misunderstandings about antibiotics were more common among women and those with less formal education **[23].** Supporting these findings, Alkhalifah *et al.* reported that antibiotic awareness was significantly associated with higher educational attainment and that awareness and appropriate practices were positively correlated (r = 0.440, p less than 0.001) **[12].** However, contrary to the absence of a consistent gender association in our study, Bawazir *et al.* found that female university students had higher odds of demonstrating positive attitudes and appropriate antibiotic practices than male students **[16].** This difference suggests that the influence of demographic characteristics may vary according to the population and study setting. Furthermore, the misconceptions identified by Albadrani *et al.* among university students indicate that formal education alone may not ensure adequate understanding of antibiotic resistance **[15].** Therefore, educational interventions should be tailored to specific knowledge gaps and health literacy needs rather than relying exclusively on demographic characteristics.

Conclusion:

Most parents showed moderate to good knowledge and a favourable attitude toward antibiotic use and resistance, although self-medication and non-prescription antibiotic use remained common. Higher income and education were associated with better knowledge, attitudes and practices, while reliance on healthcare providers highlighted opportunities for improved patient education. These findings emphasize strengthening antibiotic stewardship, enforcing prescription-only antibiotic sales and implementing targeted public health measures to promote appropriate antibiotic use and combat antimicrobial resistance.

References:

[1] Muteeb G *et al. Pharmaceuticals (Basel).* 2023 **16**:1615. [PMID: 38004480]
[2] https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance
[3] Alqahtani A *et al. Int J Pediatr Adolesc Med.* 2025 **12**:20. [DOI: 10.4103/IJPAM.IJPAM_13_25]
[4] Shah R *et al. Cureus.* 2025 **17**:e79525. [PMID: 40144439]
[5] Alzaid *et al. Int J Pharm Res Allied Sci.* 2020 **9**:115. [DOI: 10.33545/comed.2021.v4.i4a.209]
[6] https://www.ncbi.nlm.nih.gov/books/NBK570462/
[7] Naser AY Al-Shehri H *BMJ Paediatr Open.* 2025 **9:**e003698. [PMID: 40819855]
[8] Shtayyat KF *et al. The Open Nursing Journal*. 2023 **17** [DOI: 10.2174/18744346-v17-e230517-2022-171]
[9] Al-Tawfiq JA *et al. J Infect Public Health.* 2020 **13**:737. [PMID: 32008927]
[10] Alkheraije KA. *Open Vet J.* 2024 **14**:577. [PMID: 38633186]
[11] El Zowalaty ME *et al. Int J Clin Pharm.* 2016 **38**:1261. [PMID: 27573719]
[12] Alkhalifah HM *et al. J Family Med Prim Care*. 2022 **11**:1299.[PMID: 35516688]
[13] Alkhuraisi LS *et al. Cureus*. 2023 **15**:e51053. [PMID: 38269240]

[14] Alnasser AH *et al. J Public Health Res.* 2021 **10**:2276. [PMID: 34313091]
[15] Albadrani RK *et al. BMC Res Notes*. 2025 **18**:161. [PMID: 40217261]
[16] Bawazir A *et al. Int J Environ Res Public Health*. 2025 **22**:868. [PMID: 40566295]
[17] Agarwal S *et al. J Clin Diagn Res.* 2015 **9**:SC21. [PMID: 26674397]
[18] Ling Oh A *et al. J Infect Dev Ctries*. 2011 **5**:338. [DOI: 10.3855/jidc.1502]
[19] Al Hashmi AS *et al.* Sultan Qaboos Univ Med J. 2021 **21:**e289.[PMID: 34221478]
[20] Shamshu R *et al. Int J Contemp Pediatr*. 2019 **6:**2282. [DOI: 10.18203/2349-3291.ijcp20194555]
[21] Shitindi L *et al. Front Pharmacol*. 2024 **14**:1301561. [PMID: 38273839]
[22] Aljalamdeh *R et al. SAGE Open Med.* 2025 **13**:20503121251404848. [PMID: 41425798]
[23] Karuniawati H *et al. Int J Environ Res Pub Health*. 2021 **18**:8258. [PMID: 34444015]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.