

Knowledge, attitude and practice of antibiotic use and misuse among adults in Riyadh, Saudi Arabia

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ABSTRACT

الأهداف: تقييم معارف ومواقف وممارسات المضادات الحيوية (ABs) واستخدامها وإساءة استخدامها بين البالغين الذين يعيشون في الرياض، المملكة العربية السعودية.

الطريقة: في هذه الدراسة المستعرضة، تم توزيع استبيان تدار ذاتياً على المشاركين من مارس 2016م إلى يناير 2017م في قسم العيادات الخارجية بمستشفى جامعة الملك خالد ومستشفى طب الأسنان، جامعة الملك سعود، الرياض، المملكة العربية السعودية. وقد قسم الاستبيان إلى 4 أقسام. واستفسر الجزء الأول والثاني عن التفاصيل الديموغرافية والمعرفة حول الاستخدام الآمن للـ أبس. القسم الثالث تقييم ممارسة أبس والقسم الرابع استكشاف السؤال بشأن موقف المشاركين نحو استخدام القيمة المطلقة. تم تسليم الاستبيانات يدوياً إلى المستجيبين في قسم العيادات الخارجية باستخدام أخذ العينات الملائمة. تم تقديم التحليل الإحصائي للتدابير الوصفية باستخدام توزيعات التردد والنسب المئوية.

النتائج: تم الانتهاء من ما مجموعه 1966 استبيانات (معدل الاستجابة 67.4%). (93.5% من المجيبين لم يكونوا على دراية بمعنى مقاومة أبس 67.4% و 64.9% من المجيبين لم يكونوا على دراية بأن أبس ضارة بأسنان الأطفال و أبس التي قد تتسبب في الحساسية التي تؤدي إلى الوفاة على التوالي. استخدم 51% أبس دون وصفة طبية الطبيب في حين أن 37.5% الحصول على أبس مباشرة من الصيدلة دون وصفة الطبيب. ما يقرب من 42% من المشاركين أوقفوا أبس على التخفيف من الأعراض.

الخلاصة: تشير نتائجنا إلى أن البالغين أظهرت عدم كفاية المعرفة بشأن الاستخدام الآمن للـ أبس وعدم كفاية الممارسة الطبية من استهلاك أبس بين السكان. وسيكون من المفيد زيادة الوعي العام للسكان فيما يتعلق باستخدام أبس وقد تكون هناك حاجة إلى تغييرات في السياسة في مجال وصفة طبيباً.

Objectives: To assess the knowledge, attitude, and practice of antibiotics (ABs) use and misuse among adults living in Riyadh, Saudi Arabia.

Methods: In this cross-sectional study, a self-administered questionnaire was distributed to participants from March 2016 to January 2017 in the outpatient

department of King Khalid University Hospital and Dental Hospital, King Saud University, Riyadh, Saudi Arabia. The questionnaire was divided into 4 sections. The first and second section inquired regarding demographic details and knowledge of ABs. The third section assessed practice of ABs and the fourth section assessed attitude of participants towards ABs use. Questionnaires were hand delivered to respondents using convenience sampling. Statistical analysis using frequency distributions and knowledge responses of AB resistance for 'yes' and 'no' were associated with participant characteristics using Chi-square test.

Results: A total of 1966 questionnaires were completed (response rate: 93.5%). Sixty-seven percent of the respondents were unaware of the meaning of ABs resistance. Sixty-seven percent of respondents were unaware of ABs being harmful for children's teeth and 64.9% unaware of ABs that develop allergy and death. Twenty-four percent believed that ABs worked on viruses, 31% on cold and 21% can cure cough. Almost 51% used ABs without physician prescription while 37.5% obtained ABs directly from pharmacists without physician's prescription. Almost 42% participants discontinued ABs on alleviation of symptoms. There was significant difference in knowledge response of AB resistance and source of AB use ($p=0.026$), reason of AB use ($p=0.038$) and discontinuation of ABs ($p=0.041$).

Conclusion: Adults showed insufficient knowledge and understanding regarding the safe use of ABs consumption among the population.

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Antibiotics (ABs) are exclusive adjuncts in the treatment of dental and systemic infections. Although they do not substitute definitive treatment, their prudent usage can shorten infection periods and reduce associated risks, such as the spread of infection to adjacent tissue spaces or systemic involvement.¹ Increasing microbial resistance to ABs; however, is a well-documented and serious global health concern. Several reasons have been proposed to explain the poor efficacy of treatment that leads to recurrence of infection and emergence of resistant types of bacteria, most commonly that includes unprescribed dispensing of ABs to adults and its excessive use by the adult community.²⁻⁶ Increases in the rate of AB resistance has been reported in developing countries such as Saudi Arabia.^{7,8} The determinants of ABs use are of critical significance, which include physician-patient relationship, clinical microbiology, health economics, and the most basic definitions of illness and therapy.⁹ Studies have examined and shown specific causes of ABs misuse. Patient demand for antimicrobials has been shown to increase needless prescriptions,¹⁰ despite the physicians disagreement.¹¹ Such practices can, in turn enhance patient belief of the need for antimicrobials even when they are not indicated, further increasing pressure on prescribers¹² or lead to self-administration of non-prescribed ABs.¹³ There is little uncertainty that the arbitrary use of ABs has contributed to the development of bacterial resistance, both in hospitals and community settings.¹⁴ The major influence driving changes in the prevalence of resistance in the community seems to be the volume of drug use, and different epidemiological models have been proposed to describe the phenomenon.^{15,16} A thorough strategy for better ABs use is necessary for preserving, as far as possible, the considerable benefit of ABs. In particular, there is a clear need to improve the scientific understanding of the factors associated with ABs use. So far, most of the efforts for managing the use of antibacterial agents have been directed toward the prescribers: guidelines, strategies, national and international ABs policies, and educational programs. Previous studies assessing knowledge and attitude regarding AB use and misuse among adult population of Kuwait and Jordan revealed unsatisfactory knowledge regarding AB use.^{17,18} Moreover, research in different parts of Saudi

Arabia among adults showed patterns of inappropriate AB knowledge and practice.^{19,20} These studies indicate that the role of AB dispensing, prescription, knowledge about AB use, and resistance are not in line with the effective interventions. However, little is known about the significance of patient's knowledge and attitude; and contribution to AB use and misuse in Saudi Arabia. Therefore, the aim of the present cross-sectional study was to assess the state of knowledge regarding AB resistance, attitudes, and practice regarding ABs use and misuse among adults living in the community of Riyadh, Saudi Arabia.

Methods. The present study was performed using a cross-sectional design from March 2016 to January 2017. After providing verbal consent to the participants, a self-administered structured questionnaire was distributed to a sample of 2109 Saudi and non-Saudi adults. The inclusion criteria was adult patients above 18 years of age with no gender predilection and able to provide responses in the questionnaire form. Questionnaires were hand delivered to the respondents using convenience sampling in the outpatient department of King Khalid University Hospital and Dental Hospital, King Saud University, Riyadh, Saudi Arabia. Participation was voluntary and anonymous, and the questionnaire was designed based on previously published questionnaire.²¹ The study was reviewed and approved by the Research Ethics Review Committee (Research project no. E-16-2006).

The questionnaire was developed to assess the knowledge, attitudes, and practice regarding ABs use and misuse among adults living in the community of Riyadh, Saudi Arabia (**Appendix A**). The questionnaire was pre-tested on representative sample (~5% of the included study sample; n=98) to apply and validate required modifications.

The first aspect of the questionnaire inquired regarding demographic details of participants including gender, nationality, age, marital status, and education level. Second section included questions inquiring knowledge of safe ABs use, which included understanding of ABs resistance with their reasons. Subjects were also asked about the safety of ABs use including potential harm to children's teeth, allergies leading to death, and safety during pregnancy, and breast-feeding.

The questions also assessed practice of ABs use among respondents such as frequency and source of ABs use, any specific ABs usage when self-prescribed, purpose (viral, bacterial, cold/cough, or toothache) of ABs usage and when participants stop ABs intake. The questions also explored whether participants take ABs

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on time according to the instructions, do participants use leftover ABs, and how and when ABs are taken.

The fourth section assessed attitude of participants towards ABs use. This included keeping ABs at home as emergency prescription for children, taking ABs as preventive treatment before manifestation of signs or symptoms, obtaining prescription from one's own physician over the phone, and storage of ABs. Respondents were instructed to mark a single response and/or multiple where required.

Statistical analysis. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 21.0. (Armonk, NY: IBM Corp.). Statistical analysis of descriptive measures were presented using frequency distributions and percentages. Missing data was excluded from the analysis. Knowledge responses of AB resistance for 'yes' and 'no' were associated with gender, age, education level, source, reason, and discontinuation of AB use. This was analyzed using Chi-square test. 95% confidence intervals along with associated p-values were also presented. Alpha level was set at 0.05.

Results. From the 2109 questionnaires handed to the participants, 1974 (93.5%) gave the consent and completed the questionnaire. Eight subjects were excluded from the study because their responses were incomplete, leaving 1966 to be included in the analysis. Table 1 shows the demographic characteristics of the participants. Out of 1966 participants, 55% were females. Approximately 89% were Saudi nationals. Sixty-three percent of participants were young adults with an age range of 18-35 years. Approximately 58% participants were married while 53% were only high school graduates.

Table 2 summarizes the knowledge of respondents regarding ABs resistance and safety. Out of 1966 respondents, only 33% understand the meaning of ABs resistance, 45.8% agreed that ABs resistance is caused by using unwarranted ABs, and incomplete course of ABs was 55.4%. Moreover, knowledge regarding safety of ABs being harmful for children's teeth was lacking amongst 67.4% and ABs that might develop allergy leading to death was 64.9%. Approximately 62% of females showed that ABs are not safe to use in pregnancy and 55.8% in breast-feeding.

Table 3 presents the responses regarding practice of ABs usage. Most participants used ABs rarely. Respondents used self-prescribed ABs, including Amoxicillin, Augmentin, and Zithromax. Participants used ABs for treating sore throat, bacterial infection, and toothache. Approximately 58% respondents

discontinue using ABs after completing the course while 42% discontinue ABs on alleviation of symptoms.

The results of participant's attitude towards ABs use are summarized in Table 4. None of the variables such as gender, age, and education level showed statistical significance when compared with knowledge response regarding AB resistance.

Table 1 - Demographic characteristics of 1966 participants.

Characteristics	n	(%)
<i>Gender (n=1966)</i>		
Male	885	(45.0)
Female	1081	(55.0)
<i>Nationality (n=1965)</i>		
Saudi	1743	(88.7)
Non-Saudi	222	(11.3)
<i>Age (n=1966)</i>		
18-25	554	(28.2)
26-35	688	(35.0)
36-45	450	(22.9)
46-55	146	(7.4)
56-65	92	(4.7)
>65	36	(1.8)
<i>Marital status (n=1964)</i>		
Single	715	(36.4)
Married	1146	(58.3)
Divorced	82	(4.2)
Widowed	21	(1.1)
<i>Education level (n=1962)</i>		
Uneducated	30	(1.5)
Less than high school	141	(21.0)
High school	413	(52.9)
College	1040	(17.2)
Post graduate	338	(7.2)

Table 2 - Knowledge of respondents regarding antibiotics resistance and safety.

Items	n	(%)
Respondents aware of the meaning of antibiotic resistance	639/1962	(32.6)
<i>Reason for antibiotic resistance</i>		
Using antibiotics when it is not needed	291/635	(45.8)
Not completing the full course of antibiotics	350/632	(55.4)
I don't know	105/631	(16.6)
Antibiotics could be harmful for children's teeth (n=1960)	Y: 639 N: 204 DK: 1117	(32.6) (10.4) (57.0)
Antibiotics might develop allergy leading to death (n=1958)	Y: 688 N: 307 DK: 963	(35.1) (15.7) (49.2)
Antibiotics are safe during pregnancy [†] (n=1143)	Y: 78 N: 704 DK: 361	(6.8) (61.6) (31.6)
Antibiotics are safe during breast feeding [†] (n=1139)	Y: 79 N: 636 DK: 424	(6.9) (55.8) (37.2)

Y - Yes, N - No, DK - don't know, [†]items marked by females only

Table 3 - Practice of antibiotics use among the respondents.

Characteristics	n	(%)
Frequency of antibiotics usage (n=1960)		
More than once a month	78	(4.0)
Once every 1-2 months	204	(10.4)
Once every 6 months	397	(20.2)
Once every year	334	(17.0)
Rarely	947	(48.3)
Source of antibiotics (n=1960)		
Doctors' prescription	176	(8.9)
Pharmacist	733	(37.5)
Relatives	45	(2.2)
Self-prescription	1006	(51.4)
Any specific AB(s) taken on self-prescription* (n=1953)	252	(12.9)
Use of antibiotic(s)		
Viral infection	328/1965	(16.6)
Bacterial infection	746/1965	(37.9)
Fever due to viral infection	475/1966	(24.1)
Fever due to bacterial infection	567/1966	(28.8)
Cold	611/1964	(31.1)
Cough	420/1966	(21.4)
Sore throat	958/1965	(48.8)
Toothache	736/1966	(37.4)
Pain in any part of the body	270/1966	(13.7)
Generally tired	223/1966	(11.3)
Others	17/1965	(0.9)
Stopping antibiotics (n=1959)		
After finishing the antibiotics course	637	(32.5)
When patient feel better	1312	(67.0)
I don't know	10	(0.5)
Taking antibiotics on time according to the instructions (n=1951)	Y: 1604 N: 347	(82.2) (17.8)
Ever used left over antibiotics (n=1963)	Y: 620 N: 1343	(31.6) (68.4)
When would you take antibiotics? (n=1956)		
Before meals	84	(4.3)
With meals	162	(8.3)
After meals	966	(49.4)
Before or after meals (no preference)	158	(8.1)
According to instructions	586	(30.0)
How would you take antibiotics? (n=1952)		
Water	1657	(84.9)
Juice	68	(3.5)
Coffee, tea	14	(0.7)
According to instructions	196	(10.0)
Others	17	(0.9)

*response from 252 respondents saying 'yes'.
100 responses = Augmentin, 37 responses = Amoxil, other responses Zithromax, flutab. Y - yes, N - no, DK - don't know

There was significant difference in the knowledge response of AB resistance and source of AB use ($p=0.026$). The percentage of individuals not having knowledge about AB resistance and buying ABs directly from pharmacist was 73% compared to participants having knowledge about AB resistance (27%). Moreover, 70% of participants reported self-prescribed AB use. An increased percentage (72.3%) of respondents not having knowledge about AB resistance, used ABs in viral infections. There was also a statistical significant

Table 4 - Attitude towards antibiotics use among respondents.

Items	n	(%)
Keeping antibiotics at home as an emergency treatment for children (n=1956)	Y: 499 N: 1457	(25.5) (74.4)
Taking antibiotics as preventive treatment before any signs and symptoms appear (n=1961)	Y: 425 N: 1535	(21.7) (78.3)
Receiving antibiotics prescription via phone with no clinical examination (n=1951)	Y: 292 N: 1659	(14.9) (85.1)
How do you store antibiotics? (n=1955)		
Medicine cabinet	735	(37.6)
Kitchen	77	(3.9)
Refrigerator	1033	(52.8)
Others	110	(5.6)

Y - yes, N - no

difference ($p=0.041$) in the knowledge response and discontinuation of ABs. More than 60% of participants not having knowledge about AB resistance discontinued their medications when they felt better (Table 5).

Discussion. The present study showed insufficient knowledge regarding the safe use of ABs and inadequate medical practice of ABs consumption among the population. It is a well-known fact that the uncontrolled use of ABs could lead to substantial and grave adverse effects with the emergence and prevalence of resistant microbial strains.²² Resistance to ABs has been linked to levels of consumption^{23,24} with evidence of a cause-effect relationship.²⁵ Notably, in this study, only one-third of respondents understood ABs resistance and this is an alarming number. Moreover, females showed good knowledge regarding the use of ABs during pregnancy and breast-feeding. However, almost half of the respondents lacked the knowledge of safe practice of ABs on children's teeth and ABs related allergy leading to death. It appears that the positive outcome of knowledge regarding safety of ABs during pregnancy and breast feeding could be due to level of medical awareness during the period of pregnancy and consistent follow ups with their gynecologist. However, lack of knowledge regarding safe practice of ABs on children's teeth and AB related allergy leading to death could be related to lack of regular appointments with physician, acquisition of ABs from pharmacists and non-exposure to community health education programs. Therefore, it is recommended that patients should be motivated to attend regular visits with physicians (education through physicians) and arrangement for community health programs and regular health visits for patients after child birth be organized for better knowledge regarding the risks associated with ABs and child health.²⁶

Table 5 - Association of knowledge response of antibiotic resistance with demographics, source, and reason of AB use.

Characteristics	Knowledge response of AB resistance for 'yes'			Knowledge response of AB resistance for 'no'		P-value
	Total	Count (%)	95% CI	Count (%)	95% CI	
<i>Gender</i>						0.082
Male	885	389 (43.9)	(38.2-48.3)	496 (56.0)	(51.6-61.3)	
Female	1081	512 (47.3)	(42.1-52.9)	569 (52.6)	(48.1-56.9)	
<i>Age (years)</i>						0.073
18-25	554	201 (36.2)	(28.9-45.1)	353 (63.7)	(58.3-67.1)	
26-35	688	283 (41.1)	(35.7-46.5)	405 (58.8)	(51.3-64.5)	
36-45	450	289 (64.2)	(59.1-68.8)	161 (35.7)	(31.6-38.8)	
46-55	146	59 (40.4)	(33.8-46.7)	87 (59.5)	(53.8-64.5)	
56-65	92	47 (51.0)	(48.3-54.9)	45 (48.9)	(44.2-52.7)	
>65	36	18 (50.0)	(45.1-56.6)	18 (50)	(45.2-55.9)	
<i>Education level</i>						0.812
Uneducated	30	9 (30.0)	(28.4-33.1)	21 (70.0)	(61.6-79.4)	
Less than high school	141	71 (50.3)	(46.7-54.8)	70 (49.5)	(44.4-54.7)	
High school	413	124 (30.0)	(29.5-31.6)	289 (69.9)	(58.3-81.1)	
College	1040	492 (47.3)	(44.8-49.9)	548 (52.6)	(47.5-57.9)	
Postgraduate	338	195 (57.6)	(47.3-67.4)	143 (42.3)	(40.1-44.7)	
<i>Source of ABs</i>						0.026*
Doctors' prescription	176	135 (76.8)	(72.8-80.4)	41 (23.2)	(18.4-28.1)	
Pharmacist	733	198 (27.0)	(21.3-33.7)	535 (73.0)	(70.1-76.4)	
Relative	45	22 (48.8)	(43.8-53.6)	23 (51.2)	(48.6-54.2)	
Self-prescription	1006	298 (29.6)	(26.4-32.7)	708 (70.4)	(65.7-75.3)	
<i>Reason of AB use</i>						0.038*
Viral infection	328	91 (27.7)	(21.4-33.5)	237 (72.3)	(68.3-76.8)	
Bacterial infection	746	489 (65.5)	(61.2-69.2)	257 (34.5)	(27.9-41.7)	
Cold	611	198 (32.4)	(27.4-37.9)	413 (67.6)	(64.2-70.6)	
Cough	420	124 (29.5)	(24.6-34.1)	296 (70.5)	(66.6-74.8)	
Sore throat	958	578 (60.3)	(57.4-63.8)	380 (39.7)	(30.8-48.0)	
Toothache	736	236 (32.0)	(22.7-42.5)	500 (68.0)	(62.5-74.7)	
<i>Stopping antibiotics</i>						0.041*
After finishing the ABs course	637	400 (62.7)	(58.6-66.7)	237 (37.3)	(27.5-46.9)	
When patient feel better	1312	511 (38.9)	(36.7-40.2)	801 (61.0)	(59.4-62.8)	
Unclear	10	3 (30.0)	(-0.1-32.5)	7 (70.0)	(50.2-90.4)	

* $p < 0.05$. 95% CI - 95% confidence interval, ABs - antibiotics

It was clear that participants were confused about the use of ABs for either bacteria or virus since only 38% understand that they were used for bacterial infection. Most respondents thought that ABs could be used for any microbial infection. This may be attributed to improper communication, while counseling, doctors use the general term 'germs' for indication of ABs, rather than specifically mentioning bacteria.²⁷ Also, individuals do not understand the difference between bacteria and virus and hence, believe that ABs are effective for all infections.²⁸ Moreover, the present study revealed increased use (69.7%) of self-prescribed ABs and patients getting ABs without physician's consultation directly from pharmacy. In Saudi Arabia, all patients have access to ABs since a prescription is required but not necessary for their acquisition. Drug regulations that influence the access of ABs are applied differently in various countries and can play a key role in misconceptions about the use of ABs.^{29,30} A recent study in Riyadh showed that ABs can be bought without a

medical prescription by the physician.^{31,32} Therefore, the authors think that this is the possible reason for the self-prescribed ABs use among the population studied. In this regard, the relative importance of over-the-counter sales and pharmacists' attitude towards ABs should be investigated.

One of the important factors with regards to general adult use of ABs is when to discontinue the ABs intake. More than half of the respondents (67%) discontinue therapy after alleviation of symptoms. This is a misconception and could contribute to further ABs resistance and relapse of disease. Cizman,³³ reported left-over use, incorrect dosage, and early therapy discontinuation as well-recognized attitudes related to ABs compliance and misuse. Similarly, our study showed that compliance is generally unsatisfactory with regards to complete ABs coverage among adult population.

Similar results were seen in the studies conducted in Kuwait and Jordan where adults showed low level of

knowledge and inappropriate use of ABs.^{17,21} In a recent study by Awad et al,¹⁷ participants showed attitudes towards using and accessing AB inappropriately, and among them, mostly use self-medication. Almost half of the total participants showed low level of knowledge regarding AB resistance. Similarly, in a study by Shehadeh et al²¹ adults showed significant misuse and inadequate knowledge about the effectiveness and resistance of AB.

Study limitations. This study was conducted at the hospital outpatient department and so the results may not be indicative of the entire population. Moreover, patients attending outpatient department are mostly unwell (may or may not be taking ABs at the time of visit). So the findings related to the use of frequency of ABs may be skewed, introducing possible bias. Future large-scale studies are required where more heterogeneous population should be included. Secondly, as with other cross-sectional design survey, outcomes in the present study also rely partly on the honesty and recall ability of the respondents. It should be noted that this study took place in an urban setting (people are more health aware due to better access to mass media and better exposed to community health awareness programs), therefore future similar studies in rural populations and larger sample size are recommended. Also, there appears to be a relationship among the findings of poor knowledge and inadequate practice regarding the safe use of ABs (more than two-thirds of individuals had limited knowledge with regards to ABs resistance).

The main findings of the present study would form the basis for future implications to expand knowledge and better understanding regarding ABs use among Saudi population. For this purpose, the authors recommend a number of essential principles for regulating ABs misuse and resistance that should be taken into account which include setting up educational programs through mass media about the debilities that require ABs and stressing when ABs will not do any good. Moreover, controlling means of obtaining ABs by applying strict drug regulations, and highlighting pharmacists' role and responsibility in discontinuing AB sale without prescription by a physician. Moreover, this study contributes in highlighting some important concerns regarding policy making in Saudi Arabia to plan and establish future interventions related to; (i) appropriate use of ABs; (ii) auditing AB prescriptions given by health care professionals and investigating consultation behavior that may impact patients' health; (iii) improve knowledge about appropriateness of ABs and; (iv) highlighting pharmacists' and patients' role in the dispensing and buying of ABs without prescription.

In conclusion, adults showed insufficient knowledge and understanding regarding the safe use of ABs consumption among the population. Therefore, improving the general awareness of the public regarding ABs use is the need of the hour, and enforcement of regulations may be required in the area of prescription. Moreover, emphasizing other issues such as clinician behavior and lack of diagnostics should also be controlled.

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