

<http://www.pjbs.org>

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan



Research Article

Field Study on Antibiotic Use and Associated Risks Among Saudi Arabian Community Members

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Abstract

Background and Objective: Antibiotic resistance is a problem that needs to be solved, according to the World Health Organization (WHO). The main objective of this study was to uncover knowledge, attitudes and practices related to the use of antibiotics and the associated risks. **Materials and Methods:** A descriptive survey method was used to collect data from a purposive sample of Saudi citizens. A total of 2067 participants completed the study questionnaire in the period of March, 2023 to June, 2023. Questionnaire included a number of 14 questions related to the demographic characteristics of the study sample and about knowledge, attitudes and practices related to the use of antibiotics. The IBM SPSS was used to statistically evaluate the survey findings and the data were reported as frequencies and percentages. **Results:** There is a high level of awareness about what antibiotics are, their medical efficacy and how to use them among respondents, as a large percentage of respondents are convinced of the importance of taking antibiotics to treat diseases related to bacterial infection under the supervision of a specialized doctor and not based on the recommendations of their acquaintances or relatives. People with low levels of education should be among the categories specifically targeted for educational intervention regarding proper antibiotic usage. **Conclusion:** The participants who were knowledgeable about the use of antibiotics exhibited a favorable attitude towards them. While people with low levels of education needs a proper education regarding antibiotics and their uses.

Key words: Antibiotic resistance, public awareness, survey, Kingdom of Saudi Arabia, antibiotic usage

Citation: Albadrani, R.K., M.F. Albalawi, A.R. Albalawi, A.H. Alyenbawi, H.N. Almutairi and M.S. Mohamed, 2023. Field study on antibiotic use and associated risks among Saudi Arabian community members. Pak. J. Biol. Sci., 26: 386-391.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The use of antibiotics has significantly contributed to the preservation of human life¹. Antibiotic usage and misuse cause selection pressure, which results in the evolution of resistance characteristics in bacterial populations². However, the issue was not with antibiotics themselves, which remained one of the most powerful weapons against disease, rather, the issue was with how the drugs were used. Overuse or inappropriate use of antibiotics can easily result not only in the evolution of resistant bacterial strains but also in severe effects and a costly burden on the national health system³. Utilization of antibiotics and their traces in people, animals and the environment can put antibiotic resistance bacteria (ARB) and antibiotic resistance genes (ARG) under selective pressure, increasing the spread of antibiotic resistance. As, ARG spreads through the community, the burden of antibiotic resistance in humans rises, potentially affecting people's health. As a result, mitigating the transmission of antibiotic resistance to humans and reducing the burden of antibiotic resistance in humans is crucial⁴. Antibiotic-resistant bacteria cause more than 2 million infections and over 35,000 deaths each year, according to the Centers for Disease Control (CDC)⁵. Bacterial resistance is making it more difficult to treat illnesses such as pneumonia, TB, gonorrhoea and salmonellosis. Antibiotic resistance is also linked to longer hospital stays and greater medical expenses⁶. Antibiotic resistance occurs naturally, but it is increased by misuse and overuse⁵. The dilemma is aggravated in developing countries since the general populace has easy access to antibiotics. Antibiotic residues from the development and dissemination of bacterial resistance in the pertinent ecosystems is a result of medicinal and livestock settings. Hospitals, farms and agricultural areas have been noted as the main venues for the spread of ARG and ARB in earlier studies. These regions have been a management priority for regulating antibiotic usage and resistance prevention and control because they are significant sources of ARB and ARG and because they are extremely vulnerable to the spread of bacterial resistance among humans, animals and the environment. The ARB and ARG are abundant in the area around hospitals. Because antibiotic resistance affects the effectiveness of treatments, lengthens hospital stays, increases the risk of mortality and increases medical costs, it is a problem for global public health⁷. Considering that a number of things, including prescription mistakes, a lack of or poor adherence to treatment regimens based on regional sensitivities, can lead to antibiotic resistance, self-medication⁸. Inadequate infection prevention and control measures, the use of antibiotic growth enhancers in the

farmed animal business, contamination from wastewater⁹ and limited incentives for new drug surveillance, research and innovation¹⁰ the situation becomes more complicated¹¹. By 2050, resistant infections might cause 10 million deaths annually and economic damage that could be similar to the shockwaves brought on by the 2008 global financial crisis if prompt action is not taken¹¹. The WHO ranked combating the rising global burden of antimicrobial resistance as one of its top priorities. Thus, a worldwide action plan on antibiotic resistance with five strategic goals was approved by the World Health Assembly in 2015. The first objective of the strategy is to "increase awareness and understanding of antimicrobial resistance" and the fourth objective is to "optimize the use of antimicrobial medicines"¹². To achieve these goals, WHO launched a global initiative to advocate for best practices in antibiotic use among decision-makers, healthcare professionals and the general public¹². Each nation should establish a national roadmap in accordance with the global action plan to increase understanding and encourage the responsible use of antibiotics. Therefore, the aim of this research was to study knowledge, behavior and practice towards antibiotic use and resistance in the Saudi community.

MATERIALS AND METHODS

Study area: The self-administered online survey was conducted in the period of March, 2023 to June, 2023. It was distributed through the internet to Saudi citizens.

Study method: The current study belongs to the type of descriptive research studies that rely on data collection and analysis to draw conclusions.

Study population and sample: In the current study, the study population consists of citizens of Saudi Arabia and a deliberate sample of 2067 citizens was chosen.

Questionnaire: In the current study, the questionnaire was relied upon as the main tool for collecting data from the study sample. The questionnaire was designed for the current study by reviewing the previous research literature related to the subject of the current study, which deals with knowledge, attitudes and practices related to the use of antibiotics and the risks associated with them. The questionnaire included a number of (14) questions, including 3 questions related to the demographic characteristics of the study sample in terms of gender, age and educational level and 11 questions about knowledge, attitudes and practices related to the use of antibiotics and the risks associated with them.

Statistical analysis: The IBM SPSS Statistics software package (V25.0) was used to statistically evaluate the survey findings. For all tests, p-values of 0.05 or less were regarded as statistically significant and the data were reported as frequencies and percentages.

Ethical considerations: The participants were informed and assured of anonymity and confidentiality. Based on the data collected, analyzed statistically and presented below, it is impossible to identify the survey participants.

RESULTS

Respondents are quite knowledgeable about what antibiotics are, how to administer them and how effective they are in treating medical conditions, as a substantial portion of respondents are persuaded of the significance of taking antibiotics to treat diseases associated to bacterial infection under the supervision of a qualified doctor and not based on the suggestions of their acquaintances or relatives.

A total of 2067 participants completed the study questionnaire. Table 1 shows that, 44.89% of male respondents were aged between 31 and 45 years old, 38.12% of them are older than 45 years old, 9.94% of them are aged between 26 and 30 years and only 7.04% of them are aged between 18 and 25 years old.

While, 46.46% of female respondents are aged between 31 and 45 years old, 20.55% are older than 45 years, 16.68% of them are aged between 18 and 25 years old and only 16.31% of them aged between 26 and 30 years old. The data also shows that 68.92% of male respondents have a university education, 26.38% of them have high school education, 3.31% of them have intermediate education, 1.10% of them have

primary education and only 0.28% of them are uneducated. As 3.72% of them have intermediate education, 1.86% of them have primary education and only 0.45% of them are uneducated. While, 79.08% of female respondents have a university education, 14.89% of them have a high school education.

Table 2 shows that, 67.30% of respondents think that antibiotics can treat diseases caused by bacteria, which were largely due to female opinions (69.69%). In addition, 21.77% of them have no clear perception for the effectiveness of antibiotics in the treatment of bacterial diseases and infections, while only 10.93% of them said that antibiotics cannot treat diseases caused by bacteria.

As 63.47% of respondents think that antibiotics help speed recovery from cold and cough, which was largely due to female opinions (63.74%), while only (7.21%) of them have no clear perception about the effectiveness of antibiotics in helping speed recovery from cold and cough.

Furthermore, (83.55%) of respondents take their antibiotic medicines based on a prescription from a medical professional/doctor, while only (3.05%) of them do not have a clear opinion about that.

Most of the respondents (79.63%) have sufficient awareness of the importance of taking antibiotics based on the doctor's prescription and finish taking the doses as prescribed.

This awareness makes (84.91%) of the respondents completely convinced that they cannot take their friend/family member's prescription and use it to treat the same disease without any doctor's supervision, (82.87%) of them think that using antibiotics without consulting a doctor can have negative consequences for building up the body's immunity against other antibiotics and (91.44%) of them think that antibiotics cannot be used to treat all disease.

Table 1: Demographic characteristics of the respondents

Questions	Male (N = 724)		Female (N = 1343)		Total (N = 2067)	
	Number	Percentage	Number	Percentage	Number	Percentage
Age						
18-25	51	7.04	224	16.68	275	13.30
26-30	72	9.94	219	16.31	291	14.08
31-45	325	44.89	624	46.46	949	45.91
Older than 45	276	38.12	276	20.55	552	26.71
Educational level						
Uneducated	2	0.28	6	0.45	8	0.39
Primary education	8	1.10	25	1.86	33	1.60
Intermediate education	24	3.31	50	3.72	50	3.57
High school education	191	26.38	200	14.89	391	18.92
University education	499	68.92	1062	79.08	1561	75.52

Table 2: Respondents knowledge towards antibiotic usage

	Male (N = 724)		Female (N = 1343)		Total (N = 2067)		
Questions	Number	Percentage	Number	Percentage	Number	Percentage	X ² values
Q1: Does antibiotic treat diseases caused by bacteria?							
Yes	455	62.85	936	69.69	1391	67.30	X ² = 13.605 p = 0.001
No	101	13.95	125	9.31	226	10.93	
I don't know	168	23.20	282	21.00	450	21.77	
Q2: Do you think antibiotics help speed recovery from cold and cough?							
Yes	456	62.98	856	63.74	1312	63.47	X ² = 0.247 p = 0.884
No	217	29.97	389	28.97	606	29.32	
I don't know	51	7.04	98	7.30	149	7.21	
Q3: Last time you used an antibiotic, was it under a doctor's supervision?							
Yes	595	82.18	1132	84.29	1727	83.55	X ² = 4.502 p = 0.105
No	111	15.33	166	12.36	277	13.40	
I don't know	18	2.49	45	3.35	63	3.05	
Q4: Same antibiotic that was prescribed to a friend or family member can be used as long as it is to treat the same disease							
Yes	83	11.46	133	9.90	216	10.45	X ² = 1.373 p = 0.503
No	606	83.70	1149	85.55	1755	84.91	
I don't know	35	4.83	61	4.54	96	4.64	
Q5: Using an antibiotic without consulting a doctor is normal and does not have negative consequences for building up the body's immunity against other antibiotics							
Yes	94	12.98	144	10.72	238	11.51	X ² = 3.022 p = 0.221
No	586	80.94	1127	83.92	1713	82.87	
I don't know	44	6.08	72	5.36	116	5.61	
Q6: Do you think that antibiotics can be used to treat all diseases?							
Yes	62	8.56	115	8.56	177	8.56	X ² = 0.000 ^a p = 0.530
No	662	91.44	1228	91.44	1890	91.44	

Table 3: Respondents knowledge towards antibiotic resistance

Questions	Male (N = 724)		Female (N = 1343)		Total (N = 2067)		X ² values
	Number	Percentage	Number	Percentage	Number	Percentage	
Q7: Have you heard of the term antibiotic resistance?							
Yes	404	55.80	762	56.74	1166	56.41	X ² = 0.168 p = 0.682
No	320	44.20	581	43.26	901	43.59	
Q8: Did you know that using antibiotics incorrectly increases the risk of antibiotic resistance?							
Yes	593	81.91	1105	82.28	1698	82.15	X ² = 0.044 P = 0.833
No	131	18.09	238	17.72	369	17.85	
Q9: Do you know that the rapid development of antibiotic resistance poses a serious threat to public health worldwide?							
Yes	506	69.89	944	70.29	1450	70.15	X ² = 0.036 p = 0.849
No	218	30.11	399	29.71	617	29.85	
Q10: When do you think you should stop using the antibiotic you started taking?							
When I feel better	165	22.79	225	16.75	390	18.87	X ² = 14.343 p = 0.001
When I finished taking the doses previously determined by the specialist	544	75.14	1102	82.06	1646	79.63	
I don't know	15	2.07	16	1.19	31	1.50	
Q11: Where did you hear about antibiotic resistance?							
Friend or family member	104	14.36	199	14.82	303	14.66	X ² = 15.905 p = 0.001
Social media	192	26.52	442	32.91	634	30.67	
Awareness campaign	168	23.20	228	16.98	396	19.16	
Another source	260	35.91	474	35.29	734	35.51	

Table 3 shows that 56.41% of respondents have heard of the term antibiotic resistance, while 43.59% have not. Using antibiotics incorrectly can increase the risk of antibiotic resistance, 82.15% of respondents know this information well. The rapid development of antibiotic resistance poses a serious threat to public health worldwide and 70.15% of

respondents have clear knowledge about that. They get this information from a friend or family member (14.66%), from social media (30.67%) and from awareness campaigns (19.16%). However, the largest percentage (35.51%) of them obtained this information from sources other than the above.

DISCUSSION

This study surveyed Saudi citizens to assess their knowledge, attitude and practice towards antibiotic use in the form of an online questionnaire. The rapid development of antibiotic resistance poses a serious threat to public health worldwide and 70.15% of respondents have clear knowledge about that. Although, there is a slight preference in the responses of females, there is a clear convergence between their responses and the responses of male respondents with regard to antibiotic resistance and related aspects raised in this study. The results of the study by Pogurschi *et al.*¹³ have shown that Romanian citizens are less compliant when it comes to completing antibiotic treatments, as 29.19% of the respondents stop taking antibiotics if their symptoms improve. The respondents in the study sample in Nepal, other than recognizing medications, had rather excellent awareness of aspects of using antibiotics. The concept of antibiotic resistance was known but not fully understood. Higher-educated respondents tended to have better knowledge, more favourable attitudes and better practices regarding antibiotic use¹⁴. Antibiotic use was reported by 49.1% of Medellin, Colombia, medical students from three universities. Only 18.2% of those surveyed had ever heard of “antimicrobial stewardship” and only 69.3% knew that experimental antibiotic therapy causes antibiotic resistance. This attitude, according to which antibiotics should be stopped as soon as symptoms go away, was held by 11.6% of respondents. The factors associated with knowledge, attitudes and practices were found to include socioeconomic status, prior research or educational experience, general evaluation of training received and antibiotic use¹⁵.

According to the study 10.34% of respondents in the general population of Mureş County in Romania’s Central Region used antibiotics on the advice of friends or relatives, while 22.9% utilized antibiotics that were left over from a prior prescription. Among the 868 individuals who took antibiotics, 65.9% consulted their doctor each time before taking the medication. Additionally, 82.3% of the total 996 participants believed that using antibiotics without a prescription had a negative impact. Overall, most survey participants knew enough about antibiotics to know how to use them and they were aware that using antibiotics without a prescription could have negative effects on both the individual and the group¹⁶. There is a knowledge gap regarding the use of antibiotics and the consequences of antimicrobial resistance¹⁷. Chinese public health undergrads provided evidence that students believed their institutions did not provide them with adequate information about antimicrobial treatments and were eager to learn more¹⁸.

The majority of the study participants in the South Canada Region had misconceptions about the use and effects of antibiotics. Knowledge about antibiotic resistance and its causes was also limited¹⁹. Nearly 63% of students at King Saud bin Abdulaziz University for Health Sciences in Jeddah have a moderate level of knowledge, while a significant proportion of students have misconceptions about indications for antibiotic use²⁰. Regarding the data analysis in the current study, there is a wide range of knowledge about antibiotic usage and antibiotic resistance among the respondents involved in it, which means this awareness can help the public health community in different beneficial ways.

Future recommendations include campaigns to raise awareness and encourage the responsible use of antibiotics. In addition, using social media as a platform to educate a wider audience about antibiotics and the consequences of overusing them, such as antibiotic resistance, is another potential intervention strategy undertaken by governments.

CONCLUSION

Based on the distribution of the received responses, the results showed that there is a high level of awareness about what antibiotics are, their medical efficacy and how to use them, as a large percentage of respondents are convinced of the importance of taking antibiotics to treat diseases related to bacterial infection under the supervision of a specialized doctor and not based on the recommendations of their acquaintances or relatives. The findings of this study may be helpful in developing treatments by raising people’s awareness of the dangers of using antibiotics inappropriately and eradicating misconceptions about their use.

SIGNIFICANCE STATEMENT

Antibiotic resistance is one of the most urgent threats to the public’s health. It happens when germs, such as bacteria and fungi, develop the ability to defeat the drugs designed to kill them, which means the germs are not killed and continue to grow. According to our knowledge, this is the first survey that particularly evaluates public perceptions of antibiotic use and antimicrobial resistance in Saudi Arabia’s North. Despite a high level of understanding, it was found that there is still room for development. These include knowledge of the reasons why antibiotics are used, the processes that lead to antibiotic resistance and the necessity of a diversified strategy to battle resistance. Future involvement efforts to ensure data-driven campaigns and community stewardship programs aiming to improve the quality of healthcare will be informed by these results.

ACKNOWLEDGMENT

This work was supported by the Department of Biochemistry, Faculty of Science, University of Tabuk.

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