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Research Article

**KNOWLEDGE ON ANTIBIOTICS USE AND ITS STORAGE  
AMONG SAUDI ARABIA RESIDENTS: A CROSS SECTIONAL  
STUDY****Saad Alshelwi, Osama Alostaz, Salman B Suhaym, Syed MB Asdaq\*,  
Mohammed J. Al-Yamani**Department of Pharmacology and Therapeutics, College of Pharmacy,  
Al-Maarefa Colleges for Science and Technology, Riyadh, KSA**Abstract:**

*The purpose of this study was to investigate the knowledge of residents of Saudi Arabia on the antibiotic use and its storage. This was a cross-sectional study. A pre-validated questionnaire was self-administered after translation into Arabic. Demographic factors associated with respondents' knowledge were identified by multiple logistic regressions. The data obtained from the study were analyzed using statistical package for social sciences (SPSS-IBM) version 23. The questionnaires were completed by 654 (55.50% males and 44.50% females). About three-fifth (66%) of the respondents were in age group of 18-28 years and almost half (48%) of them were with academic degree. Our studies demonstrated a significant difference of average knowledge on antibiotic use as well as on its storage among different age groups and educational level ( $t = 1.27, p < 0.05$ ). The younger age group, 18-28 years, ( $OR = 2.40, 2.44$ ) and academic degree holders ( $OR = 2.48, 2.98$ ) exhibited a greater knowledge on, both knowledge on use and storage of antibiotics, respectively. The knowledge on antibiotic use and its storage is not uniform and consistent across different sections of the society. Hence there is a need to develop innovative tools and educational models to spread the awareness among general public on importance of rational use and storage of antibiotics.*

**Keywords:** Antibiotics, Good Storage practice, Knowledge, Perception, Saudi Arabia.**Corresponding author:****Dr. Syed Mohammed Basheeruddin Asdaq,**

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## INTRODUCTION:

The rampant use of antibiotics without prescription has become a global concern [1,2]. This careless and casual approach with antibiotics plays a decisive role in disseminating antimicrobial resistance [3]. Apart from its implication on healthcare sector, it has burdened economies of many countries including Saudi Arabia [4].

Irrational use of antibiotics is associated with poor safety, reduced efficacy and enhanced antibacterial resistance [5]. The impact of this misuse is more significant in societies which constitute of people with poor knowledge of antibiotics[6]. Many countries have identified this issue very early and developed strategy to spread the knowledge and awareness of antibiotics use among general public through proper channels [7].

The scenario is not very encouraging in Gulf countries, in general, and Saudi Arabia in particular on this aspect [8,9]. Despite issuance of prohibition by Ministry of health, Saudi Arabia, on dispensing of antibiotics without prescription, there is widespread violation [10]. In addition to the above, improper storage of antibiotics during its use especially reconstituted suspension, is another contributory factor for spoilage of antibiotic efficacy and will have detrimental influence on its therapeutic benefits. There are not many studies with the information on the knowledge of antibiotic use with its relevance to the storage practice in Saudi Arabia. Therefore, current study was designed to elucidate the implication of improper storage condition on possible development of antibiotic resistance. Further, an effort was made to understand the knowledge of respondents on proper use of antibiotic in Saudi Arabia.

## METHODS:

### Study design

This was a close-format self-administered questionnaire based observational study with cross-sectional design to allow for greater participation and to maintain as much confidentiality and & Saudi residents aged 18 to 65 with internet access were included in this study, while, we excluded all responses given by respondents who do not belong to the above stated age group as well as not residing in Saudi Arabia.

### Questionnaire design

Opinion and advice were obtained from teachers, experts from relevant fields, and advisors throughout the initial period of constructing the questionnaire. Initial questionnaire draft was prepared in English,

after its validation and approval from subject experts, questionnaire were translated in the native language of Saudi Arabia residents, Arabic. Arabic translated questionnaire was re-checked for content validation. Pretesting of the questionnaire was performed to gather information on its understandability, time consumed by each question, consistency among related variables and acceptability.

The two objectives of this study were to elucidate the knowledge on antibiotic use and its storage practices among the general population of Saudi Arabia.

Therefore Part I of questionnaire consisted of sociodemographic information including gender, age and educational level of participants. Part 2 of questionnaire had two sections. Section A of this part consisted of 08 questions. However, for the purpose of analysis, only two representative questions were selected as they were most appropriate to demonstrate knowledge on antibiotic use. The selected questions were, "Do you know what antibiotics are used for?" and "Do you check the expiry date of antibiotics before you use?".

The section B of part 2 was focused on assessing knowledge of participants on the antibiotic storage. There were four questions in this section. The question used for analysis for its most appropriateness was "How do you usually store the antibiotics?".

### Data collection and Statistical analysis

The Arabic-translated questionnaire was constructed via Google forms and communicated to the participants through social media (<https://t.co/NhdusEOPcC>) during February 2016 to April 2016. The data obtained from this study was analyzed descriptively using statistical package for social sciences (SPSS-IBM version 23). The Chi-square test was applied while comparing a variable of demographic feature with knowledge on antibiotic use and storage practice.  $P < 0.05$  was considered statistically significant. Logistic linear regression modeling was applied to determine the association between dependent and independent variables. In the first outcome evaluation, knowledge on antibiotic use was taken as dependent variable and the age, sex and educational level were considered as independent variable. In the second outcome evaluation, knowledge on antibiotic storage was taken as dependent variable and age, sex as well as educational level were considered as independent variable.

**Ethical approval**

Ethical approval for the research was obtained from the Research Unit, College of Pharmacy, Al-Maarefa Colleges of Science and Technology, Riyadh, Saudi Arabia.

**RESULTS:****Demographic characteristics**

General demographic characteristics are summarized in Table 1. The study was conducted on a total of 654, 55.50% were males and 44.50% were females. About three-fifth (66%) of the respondents were in age group of 18-28 years. Almost half (48%) were academic degree holders, whereas, only 3.66% were uneducated and 8.56%, 16.81% as well as 22.93% of them had primary, intermediate and high school education respectively.

**Table 1:** Demographic characteristics of participants

DEMOGRAPHIC CHARACTERISTICS	Frequency (Number)	Percentage (%)
<b>Gender</b>		
Male	363	55.50
Female	291	44.50
<b>Age (years)</b>		
18-28	430	65.74
29-39	150	22.93
≥40	74	11.31
<b>Educational level</b>		
Uneducated	25	3.82
Primary	56	8.56
Intermediate	110	16.81
High school	150	22.93
Academic degree	313	47.85

**Knowledge on antibiotic use**

As shown in table 2, comparatively, higher percentage of male respondents (46%) were aware of the correct indication of antibiotics than their female counterparts (35%). More than half of the male

respondents (54%) have used antibiotics without prescription when compared to 43% females. The selection of antibiotic has been motivated by prior successful experience in most of the cases.

**Table 2:** Knowledge of antibiotic use

KNOWLEDGE OF ANTIBIOTIC USE	Frequency	Frequency
	(percentage) Male (363)	(percentage) Female (291)
<b>Do you know what antibiotics are used for?</b>		
a) Inflammation.	152 (42)	172 (59)
b) Bacterial infection.	168 (46)	103 (35)
c) I don't know.	43 (12)	16 (5)
<b>Have you ever used antibiotics without a prescription?</b>		
a) Yes.	195 (54)	126 (43)
b) No.	168 (46)	165 (57)
<b>If yes what are the source?</b>		
a) From the internet.	8 (4)	6 (5)
b) From your friend.	26 (13)	13 (10)
c) You use it previously and it cured your illness.	115 (59)	87 (69)
d) Others.	46 (23)	20 (16)
<b>Do you know if you have an allergy to certain kinds of antibiotic?</b>		
a) No I don't have allergy.	244 (67)	162 (55)
b) Yes I have and I know that.	24 (6)	28 (9)
c) I do not know if I have or not.	95 (26)	101 (35)
<b>Have you ever used antibiotic for a couple of days without completing the course?</b>		
a) Yes.	253 (70)	180 (62)
b) No.	110 (30)	111 (38)
<b>Have you ever forced physician to prescribe an antibiotic even if he told you there no reason to take it?</b>		
a) Yes.	32 (9)	14 (5)
b) No.	331 (91)	277 (95)
<b>If you forget to take the medication, what will you do?</b>		
a) Omit the dose	49 (13)	36 (12)
b) Take a double dose at the time of next dose.	3 (0.8)	2 (0.6)
c) Take it as soon as I can.	287 (79)	232 (80)
d) Consult a pharmacist.	24 (6)	21 (7)
<b>Do you check the expiry date of antibiotics before you use?</b>		
a) Yes.	257 (71)	227 (78)
b) No.	106 (29)	64 (22)

Results (Table 3) of chi-square tests showed that the respondents' knowledge on two questions related to knowledge on the use of antibiotics. Out of the three sociodemographic factors, age (purpose of antibiotic use,  $p < 0.05$ ) and educational level (both the purpose of antibiotic use as well as practice of checking expiry,  $p < 0.05$ ) of the respondents' has significant ( $p < 0.05$ ) association with their knowledge. Moreover, according to the non-conditional multivariate logistic regression analysis results (Table 4), respondents' age (18-28 years) and educational level were also the two strongest statistically significant factors on the knowledge scale.

Compared with the reference group (uneducated), the knowledge of respondents with an intermediate, high school and academic degree were higher, with OR values of 1.89 (95%CI 1.10–3.25), 2.31 (95%CI 1.10–4.21) and 2.48 (95%CI 1.18–5.17), respectively ( $p < 0.05$ ). Taking "age  $\geq 40$  control group "as the control group, the knowledge awareness rate of respondents' with younger age group (18-28 years) was higher, the OR values being 2.47 (95%CI 1.24–4.65,  $p < 0.05$ ). Respondents' knowledge on antibiotic use was higher in younger and more educated respondents.

**Table 3:** Respondents' knowledge on antibiotic use

Demographic factors	Do you know what antibiotics are used for?		Do you check the expiry date of antibiotics before you use		Total	
	$\chi^2$	<i>p</i> -value	$\chi^2$	<i>p</i> -value	$\chi^2$	<i>p</i> -value
Respondents' gender	0.16	>0.05	0.18	>0.05	0.26	>0.05
Respondents' age	14.22	<0.05	3.98	>0.05	10.14	<0.05
Respondents' educational level	21.92	<0.05	11.19	<0.05	33.00	<0.05

**Table 4:** Non-conditional multivariate logistic regression analysis for the association between socio-demographic and knowledge on antibiotic use

Variables	$\beta$	OR	95%CI	P-value
<b>Respondents' age (age <math>\geq</math> 40 control group)</b>				
18-28	0.87	2.40	1.24-4.65	<0.05
29-39	0.35	1.42	0.65-3.10	>0.05
<b>Respondents' Educational Level (uneducated control group)</b>				
Primary	0.28	1.22	0.45-3.15	>0.05
Intermediate	0.64	1.89	1.10-3.25	<0.05
High school	0.84	2.31	1.10-4.21	<0.05
Academic degree	0.91	2.48	1.18-5.17	<0.05

\* CI = confidence interval; OR = odds ratio.

#### Knowledge on antibiotic storage

As evident from table 6, only about one fourth of the participants store antibiotics based on directions of health care professionals. It is unfortunate to notice that almost three fourth of the participants, from both genders, do not discuss with pharmacist about the

recommended storage condition for antibiotic. With their limited knowledge on the success of antibiotic treatment, most of them believe that there is no loss of potency when antibiotics are stored in improper conditions.

**Table 5:** Good storage practice

GOOD STORAGE PRACTICE	Frequency (percentage) Male (363)	Frequency (percentage) Female (291)
<b>How do you usually store the antibiotics?</b>		
a) In fridge.	143 (39)	112 (38)
b) At room temperature.	139 (38)	97 (33)
c) In the car.	01 (0.27)	00
d) As directed.	80 (22)	82 (28)
<b>Do you ask the pharmacist about the proper way to store the antibiotic?</b>		
a) Yes.	95 (26)	91 (31)
b) No.	268 (74)	200 (69)
<b>Did you ever experience the loss of potency of antibiotics when stored against medical advice?</b>		
a) Frequently	23 (6)	19 (6)
b) Infrequently	106 (29)	76 (26)
c) Never	234 (64)	196 (67)
<b>Did you ever experience formation of precipitation or change in color of your antibiotic formulation due to its improper storage?</b>		
a) Frequently	25 (7)	26 (9)
b) Infrequent	89 (24)	68 (23)
c) Never	249 (68)	197 (67)

Results (Table 6) of chi-square tests demonstrate the respondents' knowledge on storage of antibiotics. There was significant ( $p < 0.05$ ) impact of two sociodemographic factors, age and educational level of the respondents', on the knowledge level of antibiotic storage. Further, as evident from the non-conditional multivariate logistic regression analysis results (Table 7), age (18-28 years) and educational level were also the two potential statistically significant factors on the knowledge scale. When we compared with reference group (uneducated), the knowledge on antibiotic storage of respondents with an intermediate, high school and academic degree were higher, with OR values of 1.98

(95%CI 1.10–4.11), 2.37(95%CI 1.28–4.28) and 2.98 (95%CI 1.23–4.78), respectively ( $p < 0.05$ ). When we took age “ $\geq 40$  control group “as the control group, the knowledge on antibiotic storage of respondents’ with younger age group (18-28 years) was higher, the OR values being 2.44 (95%CI 1.56–4.89,  $p < 0.05$ ). Similar to our above finding, knowledge on storage of antibiotic was more among young and educated respondents.

**Table 6:** Respondents’ knowledge on antibiotic storage

Demographic factors	How do you usually store the antibiotics?	
	$\chi^2$	<i>p</i> -value
Respondents’ gender	0.11	>0.05
Respondents’ age	13.22	<0.05
Respondents’ educational level	18.42	<0.05

**Table 7:** Non-conditional multivariate logistic regression analysis for the association between socio-demographic and knowledge on antibiotic storage

Variables	$\beta$	OR	95%CI	<i>P</i> -value
<b>Respondents’ age (age <math>\geq 40</math> control group)</b>				
18-28	0.86	2.44	1.56-4.89	<0.05
29-39	0.21	1.23	0.86-5.90	>0.05
<b>Respondents’ Educational Level (uneducated control group)</b>				
Primary	0.22	1.08	0.42-2.16	>0.05
Intermediate	0.54	1.98	1.10-4.11	<0.05
High school	0.79	2.37	1.28-4.38	<0.05
Academic degree	0.98	2.98	1.23-4.78	<0.05

## DISCUSSION:

Knowledge of general populations on antibiotic use and storage can greatly influence the way they are consumed for the desired purpose. Assessment of knowledge level on antibiotics may provide valuable information which could help towards developing interventions targeting to improve their use. Therefore this study was done to evaluate Saudi Arabia residents’ knowledge on antibiotic use and its storage practice. We aim to utilize this information to impact Saudi Arabia’s awareness programs on antibiotics.

In terms of knowledge on antibiotic use, it was discouraging to note that a good percentage of the participants were unaware of the indications for use of their medications, similar to the results of a study conducted in Oman where only 54% were aware that antibiotics are used to treat infections [11]. Another disappointing revelation of this study is that almost half of the respondents have experience of purchasing antibiotics without prescription that is higher than other study done in Ireland [12]. The indiscriminate use of antibiotic is very rampant with more than two third of the study participants have habit of

discontinuing antibiotic use after attaining relief in couple of days leading to antimicrobial resistance. Using antibiotics for a short period of time, usually till the symptoms subside, exposes the infecting bacteria to the sub-therapeutic levels of antibiotics, which leads to bacterial resistance to the antibiotics [13,14]. Apparently, this must have been due to the poor education level of the participants. A good knowledge on antibiotic use is usually observed in general public based on the awareness about medications. A good awareness is possible with higher educational level. There are several studies that shows association between educational level and awareness on the health care including rational antibiotic use [15]. We found a good knowledge on the purpose and habit of checking expiry among the participants with higher qualification. Further, individuals with higher literacy also showed a higher level of knowledge on storage of antibiotics. Our study outcomes are in accordance with other studies done elsewhere [16,17].

It is a known fact that the storage of pharmaceuticals plays an important role in maintaining their therapeutic efficacy. Manufacturers of these

preparations usually publish ideal/good storage requirement on their packets based on the stability studies carried out during their preparation [18]. While these conditions have to be maintained for all pharmaceutical preparations, their adherence becomes more imperative for substances such as antibiotics, sera and other biological. Improper storage due to unwanted exposure to oxygen, heat, light, or humidity may lead to failure of potency and emergence of secondary manifestations in kidney, stomach and other organs. Hence proper storage of the antibiotics is the cornerstone for its desired therapeutic benefit. Therefore, we seek to find the answer of the respondents by which way they store the antibiotics. We found a positive association among young population in an age group of 18-28 years with high/better qualification and knowledge on proper storage of antibiotics. Our observations are similar to the observation on knowledge on and that in both groups most of them store antibiotics in fridge and also at room temperature. Unfortunately, there are very few respondents replied that they store antibiotics as directed by healthcare professionals. It was surprising to note that majority of the respondents do not experience any loss of therapeutic efficacy of antibiotic despite not storing them under proper and good storage condition. This might probably be due to moderate or less deviation from standard storage requirement. These observations by the respondents on the intact therapeutic potency could also be casual. Further studies could be done to elucidate the extent of deviation from storage requirement and its impact on therapeutic potency by employing scoring scale.

This study was a cross-sectional study carried out within a short period of time, sample size was small and most of the respondents were young and having an internet access with academic degrees; thus the results is not sufficient to generalize the knowledge level of ordinary residents of Saudi Arabia. The situation might be more alarming than it is shown in the study. Since the study was carried out during February and April months, climatic conditions during these months are good in Saudi Arabia with an average temperature of 25 degree Celsius. It would be more appropriate to study the implication of improper storage during harsh climatic months between May to September. Hence we suggest making a comparative study on impact of storage deviation in different climatic conditions to exhibit importance of good storage practice.

### CONCLUSION:

This research revealed a high prevalence of misuse of antibiotics in Saudi Arabia and this may be due to

poor education and knowledge. Moreover, there is unawareness of proper storage among public in Saudi Arabia. However, there is lack of evidence to support our hypothesis for loss of therapeutic potency of antibiotics when standard storage requirements were not followed.

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### REFERENCES:

1. Norris P. Interventions to Improve Antimicrobial Use: Evidence from ICIUM 2004, School of Pharmacy, University of Otago Dunedin, 2004. Available from: [http://www.who.int/medicines/publications/improve\\_antimicrobia\\_%20use\\_evidence\\_ICIUM2004.pdf](http://www.who.int/medicines/publications/improve_antimicrobia_%20use_evidence_ICIUM2004.pdf).
2. Togoobaatar G, Ikeda N, Ali M, Sonomjamts M, Dashdemberel S, Mori R et al. Survey of non-prescribed use of antibiotics for children in an urban community in Mongolia. *Bulletin of the World Health Organization* 2010; 88: 930-936. doi: 10.2471/BLT.10.079004.
3. Franchi C, Sequi M, Bonati M, Nobili A, Pasina L, Bortolotti A et al. Differences in outpatient antibiotic prescription in Italy's Lombardy region. *Infection* 2011; 39: 299-308.
4. World Health Organization, WHO Global Strategy for Containment of Antimicrobial Resistance, World Health Organization, Geneva, Switzerland, 2001. Available from: [http://www.who.int/drugresistance/WHO\\_Global\\_Strategy\\_English.pdf](http://www.who.int/drugresistance/WHO_Global_Strategy_English.pdf).
5. Byarugaba D. Antimicrobial resistance in developing countries and responsible risk factors. *Int J Antimicrob Agents* 2004;24:105-110.
6. Arul Prakasam K, Senthil NK, Ramesh J. Students' knowledge of antibiotics: a cross-sectional study of students in Tamil Nadu. *Int J Pharm Pharm Sci.* 2011;3:23-29
7. Huttner B, Goossens H, Verheij T, Harbarth S. Characteristics and outcomes of public campaigns aimed at improving the use of antibiotics in outpatients in high-income countries. *Lancet Infect Dis* 2010;10:17-31.
8. Tenaiji A, Redha KA, Khatri F, Darmaki S, Hosani S, Neaimi MA, et al. Hashmey R. Knowledge, attitudes and behavior towards antibiotic use among parents in Al-Ain city,

- United Arab Emirates. *Int J Infect Dis* 2008;12:e434.
9. Al-Rasheed A, Yagoub U, Alkhashan H, Abdelhay O, Alawwad A, Al Aboud A, et al. Prevalence and Predictors of Self-Medication with Antibiotics in Al Wazarat Health Center, Riyadh City, KSA. *Biomed Res Int* 2016; 2016: 3916874.
  10. Khan TM, Ibrahim Y. A qualitative exploration of the non-prescription sale of drugs and incidence of adverse events in community pharmacy settings in the Eastern Province of the Kingdom of Saudi Arabia. *Eur J Hosp Pharm* 2013;20:26–31.
  11. Jimmy Jose, Beena Jimmy, Al Gahliya Mohammed Saif AlSabahi, and Ghalya Abdullah Al Sabei. A Study Assessing Public Knowledge, Belief and Behavior of Antibiotic Use in an Omani Population. *Oman Med J* 2013;28:324-330
  12. Cunney R, Murphy N. Household antibiotic use and antibiotic beliefs in Ireland. SARI. Available at URL: <https://www.hpsc.ie/a-z/microbiologyantimicrobialresistance/strategyforthecontrolofantimicrobialresistanceinirelandsari/keydocuments/File,1070,en.pdf>. Accessed on January 20,2018.
  13. Austin DJ, Kristinsson KG, Anderson RM. The relationship between the volume of antimicrobial consumption in human communities and the frequency of resistance. *Proc Natl Acad Sci USA* 1999; 96: 1152–1156.
  14. Okeke IN, Laxminarayan R, Bhutta ZA, Duse AG, Jenkins P, O'Brien TF, Pablos-Mendez A, Klugman KP. Antimicrobial resistance in developing countries. Part I: recent trends and current status. *Lancet Infect Dis* 2005; 5: 481493.
  15. Richman PB, Garra G, Eskin B, Nashed AH, Cody R. Oral antibiotic use without consulting a physician: a survey of ED patients. *Am J Emerg Med* 2001;19:57–60.
  16. Kardas P, Devine S, Golembesky A, Roberts C. A systematic review and meta-analysis of misuse of antibiotic therapies in the community. *Int J Antimicrob Agents* 2005;26:106–113.
  17. Corbett KK, Gonzales R, Leeman-Castillo BA, Flores E, Maselli J, Kafadar K. Appropriate antibiotic use: variation in knowledge and awareness by Hispanic ethnicity and language. *Prev Med* 2005;40:162–169.
  18. Ivana I, Ljiljana Z, Mira Z. A stability indicating assay method for cefuroxime axetil and its application to analysis of tablets exposed to accelerated stability test conditions. *J Chromatography* 2006; 1119: 209–215.