

## Knowledge, attitude and practice of antibiotic use and misuse among adults attending Primary health care in Arar city, Saudi Arabia

**To Cite:**

Alanazi AM, Alenezi FSG, Alanazi TDM, Alhumaid TMA, Hammad SM, Mohammed AE. Knowledge, attitude and practice of antibiotic use and misuse among adults attending Primary health care in Arar city, Saudi Arabia. *Medical Science*, 2021, 25(111), 1173-1182

**Author Affiliation:**

<sup>1</sup>Resident family medicine physician, Saudi Board of Family Medicine, joint program, Northern Border Region, Kingdom of Saudi Arabia

<sup>2</sup>Professor of Public Health & community Medicine, Faculty of Medicine, Mansoura University, Egypt & Consultant of Public Health & Community Medicine, Northern Border General Health Affairs, KSA

<sup>3</sup>Lecturer of Public Health & Community Medicine, Faculty of Medicine, Zagazig University, Egypt

**Peer-Review History**

Received: 01 April 2021

Reviewed & Revised: 02/April/2021 to 11/May/2021

Accepted: 12 May 2021

Published: May 2021

**Peer-review Method**

External peer-review was done through double-blind method.

**Amer Mohammed Alanazi<sup>1</sup>, Fayez Sulobi G Alenezi<sup>1</sup>, Talal Duhaim M Alanazi<sup>1</sup>, Tariq Majed A Alhumaid<sup>1</sup>, Sabry Mohammed Hammad<sup>2</sup>, Amal Elwan Mohammed<sup>3</sup>**

### ABSTRACT

**Background:** Antimicrobials are the communal drugs used in the developing countries. The irrational use of antimicrobial drugs is a huge problem on national health system. **Objectives:** To assess the knowledge, attitudes and practices of patients regarding antibiotic use and misuse at Arar city, kingdom of Saudi Arabia. **Methods:** A cross sectional study will be conducted in 4 PHC centers out of 14 centers at Arar city, Northern Border Region, Saudi Arabia, between the 1st May 2019 and the 31th July 2019. The target population was patients attending in 4 Primary Health Centers. **Results:** Data of the present study showed a relatively good knowledge score (62.6±25.6) regarding the safe use of antibiotics in the populace. Only 56.6% of the applicants knew that antibiotics can cause allergic reaction may lead to death and 70.6% of them knew that it's not harmless to usage antibiotics during pregnancy and 62.8% knew that antibiotics are not safe during breast feeding. However, almost 60% of the applicants lacked the knowledge of safe practice of antibiotics on children's teeth. Only 284 (59.3%) of our contributors had information about antibiotics resistant problem. As regards the attitude, about fifth (18.2%) of the applicants prefers to buy an antibiotic without a prescription. About quarter (22.1%) think that a good doctor depends on the antibiotic being prescribed. Regarding practice, only 10.9% of the contributors reported self-prescription of antibiotics, 5.2% reported pharmacist consultation, 5.4% reported family member advice and 78.5% reported the doctor's prescription as a source of antibiotics using. **Conclusion:** The current study showed a relatively good knowledge score, and bad attitude regarding the safe use of antibiotics among the population. Study results revealed good results regarding the source of antibiotics and self-medication. Increase the awareness of the public concerning the using of antibiotics and drug resistant strains is highly needed.

**Keywords:** Knowledge, attitude, practice, antibiotic, misuse, primary health care (PHC), Arar city, Saudi Arabia



## 1. INTRODUCTION

Antimicrobial medications remain the backbone clinical medicine and have saved countless patients from life-threatening microbial infections (Davey et al., 2013). Antimicrobials are the mutual drugs used in the developing countries where the infectious diseases remain a threat (Gebeyehu et al., 2015). However, the last decade of the 20th century and the first decade of the 21th century have seen the spread of antibiotics (ABs) resistance of multi type of pathogenic bacteria worldwide resulting in increased morbidity, mortality and extended hospital stays (Davey et al., 2013; Hyun et al., 2013).

It was calculated that 23,000 deaths and more than two million illnesses stayed triggered by antimicrobial resistance (CDC, 2013). By 2050, Abs confrontation would lead to 10 million people dying every year except if the tricky of antibiotic confrontation is stopped by a global effort (O'Neill, 2014). In US the total economic cost of Abs resistance ranged from \$20 billion to \$35 billion a year (Roberts et al., 2009). The irrational consumption of antimicrobial medications stands a huge problem on national health system, moreover It is obvious that usage of antibiotic medication affects microorganism, individual person and the community in general (Rubin & Samore, 2009).

Several factors have been proposed to explain the increase of ABsm is appropriation including cultural factors, behavioral factors, lack of health education, socio- economic status, schooling, patients'/parents' pressure on doctors and pharmacists, Self-medication and Socio-demographic factors such as gender, age, income levels, education, and geographical locations (Alumran et al., 2011; Pechère, 2001; Cebotarenco & Bush 2007; Donkor et al., 2012; Al-Ahmadi & Al-Hindi, 2020).

A study was done in Italy to assess patient knowledge toward Abs use: 9.8% of respondents knew the exact definition of antibiotic opposition, 21.2% did not know when it is appropriate to use it, and 50% believed that the Abs lose their effectiveness if the treatment is stopped. Further, 80.7% showed good knowledge to use antibiotic not to treat a common cold, conversely, lower values have been observed toward avoidance of usage in treatment of sore throat, flu and fever (Mora-Cancino & Hernández-Valencia, 2015). Regarding the patients' attitudes towards ABs consumption, study in South Africa displayed 46% of participants believed that the doctor must prescribe more than one antibiotic if the patient has severe flu, 34% request Abs even if the doctor has advised against it, 42% said that Abs help them recover from a cold much quicker, 37% always felt that they needed an antibiotic when they developed a sore throat and 43% preferred to be able to buy antibiotics directly from the drug store without a doctor's prescription (Ramchurren et al., 2018).

In addition, a research in Kuwait, stated that inadequate knowledge and irrational ABs consumption of patients, moreover most of participants used self-medication and half of them showed deficiency of information regarding antimicrobial resistance. Over 76.6% of respondents expressed positive behavior towards not to get Abs from friends or relatives without a medical consultation, 66.6% were not inclined to bring Abs from the drug store without a doctor prescription, 55.7% were agreeing not to save antibiotics at home for an emergency use, and 57.6% felt to always complete the course of ABs. Nevertheless, 73.4% expressed negative behaviors towards ABs usage for treatment of sore throat and 57.1% to treatment of cough (Awad & Aboud, 2015). In a similar research in Jordan, participants showed significant misuse and insufficient information about ABs resistance (Shehadeh et al., 2012). In 2017 a study was conducted in Riyadh which showed scarce info for the harmless usage of antimicrobial medications besides insufficient medical practice of antibiotics consumption among the population. Only 30% showed good knowledge regarding Abs opposition, then females displayed sufficient concept for use of antibiotics among pregnancy and breast-feeding. Moreover, respondents also had low information regarding unexpected result of Abs on children's teeth, and death related to antimicrobial allergy. Almost two third of participants didn't comprehend the difference between bacteria and virus, while one third understood that Abs custom is for bacterial infection only. Regarding patients' attitudes towards use of Abs 25.5% of respondents kept antibiotics at home as an emergency treatment for children, 21.7% took antibiotics as preventive treatment before any signs and symptoms appeared, and 14.9% received antibiotics prescription via phone with no clinical examination (Al-Shibani et al., 2016).

Other researches, in Riyadh, showed that the frequency of non-prescribed Abs use among the Saudi children was 43.6%. Antibiotics could be dispensed without a prescription by medical doctor and hence, the authors believed that this is the likely reason for the self- prescribed Abs use by the population studied (Alanazi et al., 2013; Abdulkhak et al., 2011; Al Rasheed et al., 2016). Upon reviewing the literature, no studies done in Arar, Northern Saudi Arabia, exploring awareness, arrogance and rehearsal of usage of antibiotics and misuse among adults in PHC. Therefore, we will conduct our study to measure the knowledge, attitude and practice of Abuse and misuse in PHC patients.

### Study Objectives

To assess the knowledge, attitudes and practices of patients regarding the usage of ABs besides its misuse at Arar, Northern Saudi Arabia

**Secondary**

To discover the association of knowledge, positive/negative attitude and behavior of patients towards Abs use and misuse  
Prevalence of abuse of Abs among primary care patients

**Subjects & Methods**

*Design of the study and time period:* A descriptive KAP study carried out in 4 PHC centers out of 14 centers at Arar city, Northern Border Region, KSA, between the 1st May 2019 and the 31th July 2019.

*Target population:* patients attending in 4 Primary Health Centers.

**Selection criteria**

*Inclusion Criteria:* Patients who are 16 years and older, who are mentally competent, Irrespective of their gender or nationality

**Sample size**

By the valid formula of deciding the size of the samples intended for cross sectional researches (Charan and Biswas, 2013):

$$n = Z^2 p (1 - p) / d^2$$

n= sample size. P = proportion, picking a choice was 32.6% =1.96 for confidence level 95%, and d=0.05 for confidence interval and acceptable margin error of 5%.

Depending on this formula, the minimum sample size is 338, sample size will be 372 after adding 10% non-response rate.

**Study tool**

The sample (372) was divided between the 4 randomly selected PHCs, so 93 patients will be selected from each PHC, three weekly field visits was done to the selected PHC. Ten patients were selected randomly during each visit. The participant interviewed, and by using questionnaire, which was approved by a previous study (Al-Shibani et al., 2017), the researcher done some modification on it. The questionnaire was revised by three experts for validity. The questionnaire was separated into 4 divisions. The first and next divisions queried concerning demographic data and awareness of ABs. The third division measured practice of antibiotics usage then the fourth division measured attitude of participants towards Abs use.

**Data Analysis**

Data record then inquiry was performed using statistical package for the social science program (SPSS) version 20. Categorical variables will be presented as number and percentage and continuous variables as mean standard deviation. Appropriate statistical test was used for comparing groups, P<0.05 was used to indicate statistical significance. Statistical enquiry by means of frequency deliveries and awareness replies of Abs resistance for 'yes' and 'no' were associated with contributor features by Chi-square test.

**Ethical considerations**

Before starting interview, informed consent was taken from all study participants and we will assure them that confidentiality of their data was maintained during the study. Research clearance and approval was obtained from research ethical committee of Northern Border General Health Affairs. Also, administrative approval was taken from administrator of each PHC center.

**3. RESULTS**

Table 1 describes description of Socio-demographic features of the participants. The study we included 479 contributors from the overall inhabitants of Arar city, 309 (64.5%) were females and 170 (35.5%) were males, they all were in the age between 18 and 65 years old then the main part of them were Saudi citizens. Table 2 illustrates the knowledge of the applicants on using of antibiotics. Data of the current study showed a relatively good score of knowledge (62.6±25.6) regarding the safe use of antibiotics in the populace. It was clear that participants were confused about the allergic influence of the consumption of ABs, since only 56.6% of the participants knew that Abs can cause allergic reaction may result in death. our participants showed good knowledge regarding the use of antibiotics during pregnancy and breast-feeding, as 70.6% of them knew that it's not safe to use ABs during pregnancy and 62.8% knew that ABs are not safe during breastfeeding. However, almost 60% of the contributors lacked the information of safe practice of Abs on children's teeth. Only 284 (59.3%) of our participants had information about antibiotics resistant problem, which is insufficient result.

Table 3 shows attitude of participants on usage of ABs. 44.5% agree and 19.6% strongly agree that antibiotic helps in faster recovery with a cold, while 44.9% disagree and 20.9% intensely disagree to order Abs even if my doctor advised me otherwise. About fifth (18.2%) of the applicants prefer to buy an antibiotic myself without a prescription. About quarter participants (22.1%) think that a good doctor depends on the Abs being prescribed. Table 4 shows practice of participants on the consumption of antibiotic. Study results revealed good results regarding the source of ABs, as only 10.9% of the participants reported self-prescription of ABS, 5.2% reported pharmacist consultation, 5.4% reported family member advice and 78.5% reported the doctor's prescription as a source of antibiotics using. As regards the general adult use of ABs is when to discontinue the antibiotics intake. In our study, 45.1% of the respondents stop using the Abs just after feeling better (figure 1 & 2).

Table 5 shows knowledge and attitude scores in association with demographic factors. We found a significant relation between knowledge score and marital status, level of education and frequency of Abs intake with P value= (0.015, 0.000, 0.004) respectively, however the significant relation with attitude was recorded to be with nationality, educational level, frequency of antibiotics intake and source of antibiotics with P value= (0.030, 0.000, 0.000, 0.000) respectively.

**Table 1** Description of Socio-demographic features of the participants (N=479).

Parameter	Frequency	Percent
Gender		
Female	309	64.5%
Male	170	35.5%
Age		
< 34 years	279	58.2%
34 years -	170	35.5%
> 48 years	30	6.3%
Mean±SD (Min-Max)	32±10 (18-65)	
BMI		
Saudi	476	99.4%
Non-Saudi	3	0.6%
Marital status		
Widowed	2	0.4%
Single	151	31.5%
Married	316	66.0%
Divorced	10	2.1%
Educational level		
Less than secondary education	7	1.5%
Secondary education	80	16.7%
University degree	349	72.9%
Post-graduate studies	43	9.0%

**Table 2** Knowledge of participants on ABs use (N=479).

Knowledge items	Yes	No	I don't know
Is ABs resistance a worldwide problematic?	284 (59.3%)	63 (13.2%)	132 (27.6%)
Do you think antibiotics during pregnancy could harm new-born baby's teeth?	200 (41.8%)	70 (14.6%)	209 (43.6%)
Do you think antibiotics could cause allergic reactions that cause death?	271 (56.6%)	91 (19%)	117 (24.4%)
Do antibiotics have side effects?	406 (84.8%)	29 (6.1%)	44 (9.2%)
Antibiotics alleviate pain.	293 (61.2%)	159 (33.2%)	27 (5.6%)
Do you think it is no harm to use an antibiotic during pregnancy?	57 (11.9%)	338 (70.6%)	84 (17.5%)
Do you think that, using of antibiotic while breastfeeding is harmless?	74 (15.4%)	301 (62.8%)	104 (21.7%)

**Table 3** Attitude of participants on ABs use (N=479).

Attitude items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I always expect a doctor to prescribe an antibiotic when I feel sick.	119 (24.8%)	177 (37%)	96 (20%)	68 (14.2%)	19 (4%)
The antibiotic helps me recover faster with a cold.	94 (19.6%)	213 (44.5%)	61 (12.7%)	86 (18%)	25 (5.2%)
I would order ABs even if my doctor advised me otherwise.	26 (5.4%)	70 (14.6%)	68 (14.2%)	215 (44.9%)	100 (20.9%)
I will probably get into an argument with the doctor when he does not prescribe an antibiotic for me.	18 (3.8%)	42 (8.8%)	56 (11.7%)	213 (44.5%)	150 (31.3%)
I prefer to buy an antibiotic myself.	24 (5%)	63 (13.2%)	56 (11.7%)	186 (38.8%)	150 (31.3%)
I expect greater benefit when I take the antibiotic as per doctor's instructions.	233 (48.6%)	186 (38.8%)	33 (6.9%)	19 (4%)	8 (1.7%)
I do not ask for more than antibiotic when I have a severe cold.	99 (20.7%)	191 (39.9%)	89 (18.6%)	63 (13.2%)	37 (7.7%)
My perception of a good doctor depends on the antibiotic being prescribed.	34 (7.1%)	72 (15%)	123 (25.7%)	167 (34.9%)	83 (17.3%)
When using a prescription antibiotic that has proven effective, I may recommend it to others.	50 (10.4%)	111 (23.2%)	76 (15.9%)	141 (29.4%)	101 (21.1%)

**Table 4** Practice of participants on ABs use (N=479).

Practice items	No.	Percentage
I am taking an antibiotic:	More than once a month	27 5.6%
	Once every 1-2 months	55 11.5%
	Once every 6 months	98 20.5%
	Once a year	37 7.7%
	Scarcely	262 54.7%
Source of ABs	Consult a pharmacist	25 5.2%
	Family member	26 5.4%
	Self prescription (myself)	52 10.9%
	A doctor's prescription	376 78.5%
When to stop using the antibiotic?	Upon completion of the period (completing the required doses)	263 54.9%
	When feeling better	216 45.1%
Do you commit to taking the antibiotic on time according to the prescription?	No	109 22.8%
	Yeah	370 77.2%

Have you ever used the remaining antibiotic from a prior instruction?	No	277	57.8%
	Yeah	202	42.2%
When to take an antibiotic?	after eating	206	43.0%
	As directed by the doctor	243	50.7%
	Before or after eating	24	5.0%
	before eating	6	1.3%
How to store the antibiotic?	Other	14	2.9%
	bedroom	5	1.0%
	In the refrigerator	238	49.7%
	In the kitchen	32	6.7%
	In the medicine cabinet	190	39.7%
How do you take an antibiotic?	Other	7	1.5%
	As directed by the doctor	67	14.0%
	With a cup of water	405	84.6%

**Table 5** Knowledge and attitude scores in association with demographic factors (N=479).

Parameter		Knowledge Score Mean±SD	Attitude Score Mean±SD
Sex	Female	63.6±23.4	50.4±22.7
	Male	62.2±28	53.7±24.2
	<i>P-value*</i>	0.572	0.185
Nationality	Saudi	63±25.1	51.4±23.2
	Non-Saudi	85.2±17	81.5±17
	<i>P-value*</i>	0.107	0.030
Age	< 34 years	63.3±27.3	52.9±24.4
	34 years -	62.8±22.1	49±21.7
	> 48 years	63±19.4	53.3±19.4
	<i>P-value**</i>	0.933	0.247
Marital status	Widowed	50±55	27.8±23.6
	Single	57.9±25.6	53.1±24.5
	Married	65.4±24.4	50.8±22.6
	Divorced	71.1±23.5	57.8±23.3
	<i>P-value**</i>	0.015	0.323
Educational level	Less than secondary education	61.9±21.1	76.2±7.7
	Secondary education	52.1±27.1	52.1±20.7
	University degree	64.2±23.8	49.6±22.9
	Post-graduate studies	74.9±25.6	62.8±27.1
	<i>P-value**</i>	0.000	0.000
I am taking an antibiotic	More than once a month	53.5±27.4	35.4±17.4
	Once every 1-2 months	56±23.3	37±20.3
	Once every 6 months	61.6±21.5	46.3±22
	Once a year	73.3±23.4	56.2±25.4
	Scarcely	64.8±26.1	57.6±22
	<i>P-value**</i>	0.004	0.000

Source of antibiotic	Consult a pharmacist	64.9±30	42.2±17
	Family member	58.1±24.2	35.5±19.9
	Self prescription (myself)	56.4±24.9	40.4±28.4
	A doctor's prescription	64.3±24.7	54.9±22
	<i>P-value**</i>	0.150	0.000

\*Mann-Whitney U test was used.

\*\* Kruskal-Wallis H test was used.

Figure 1. Box plot of the attitude score and practice of unprescribed antibiotic intake

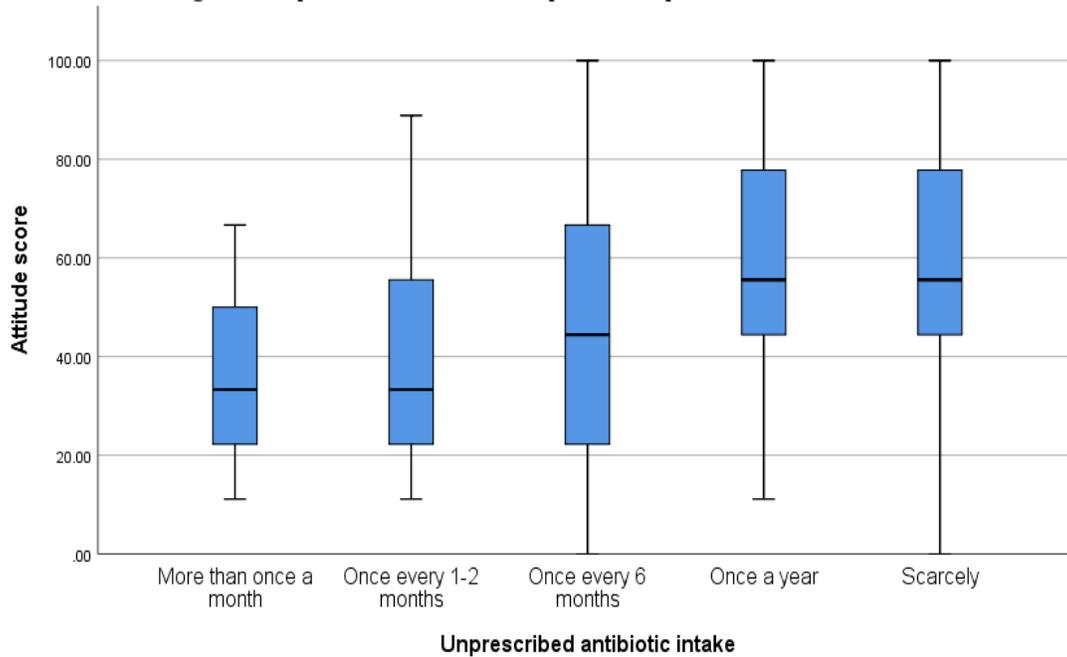
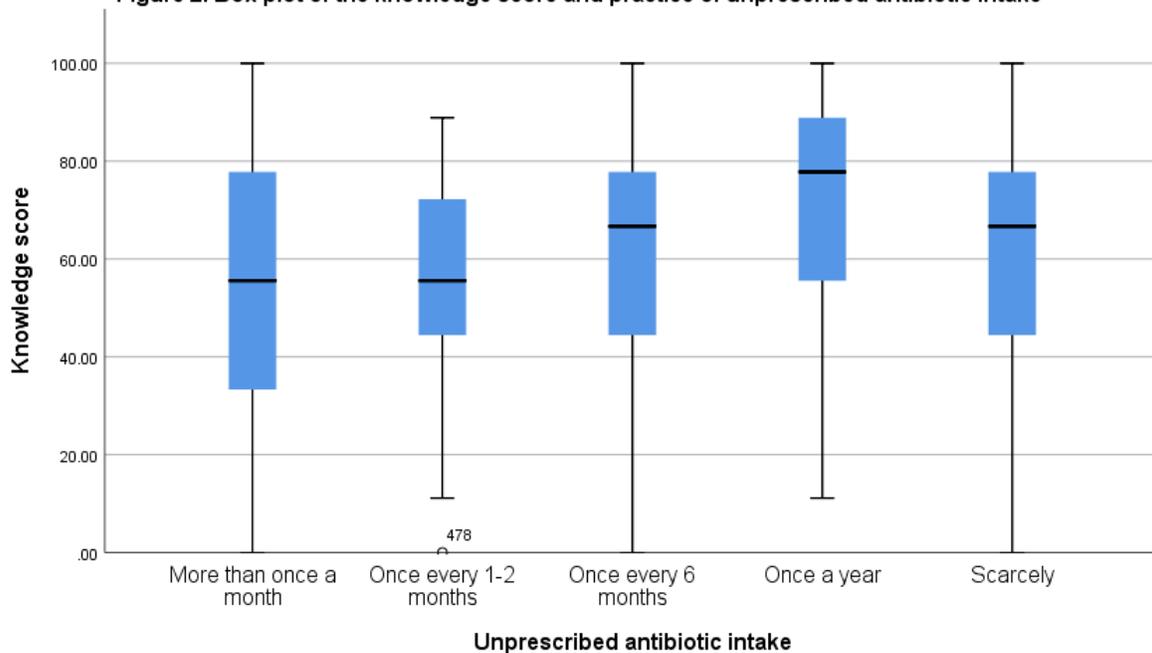


Figure 2. Box plot of the knowledge score and practice of unprescribed antibiotic intake



#### 4. DISCUSSION

Awareness, attitude and practice about antibiotics usage amongst the populations of numerous nations have been considered to an inadequate level (Al-Bakri et al., 2005). Therefore, this is the first known study to be conducted in Arar city, KSA to comprehensively demonstrate knowledge, attitudes, and practice towards using of Abs in the community. The present data would be the first line in providing a baseline quantitative data of patterns of awareness, attitudes and practicing regarding antibiotics among Arar general population, which will help in the valuation of the suitability of the present community educational campaigns on ABs, and provide more vision in designing future many-sided interventions targeting more specific areas in KSA to promote rational Abs usage, and replenish the awareness and attitude gaps as an effort against antibiotic misuse and resistance.

In the current study we included 479 applicants from the overall populace of Arar city, 309 (64.5%) were females and 170 (35.5%) were males, they all were aged 18 and 65 years old. The current study showed a relatively good knowledge score ( $62.6 \pm 25.6$ ) regarding the safe use of Abs in the populace. These results are unlike what was reported in Riyadh city, KSA (Al-Shibani et al., 2017). They found a lower score of awareness in their citizens, however in their study there was inadequate practice level. Another result was reported in other previous researches in Kuwait and Jordan where adults showed low score of information and unsuitable use of ABs. (Cizman, 2013; Shehadeh et al., 2012). In a recent study by Awad et al., (2015), participants showed inappropriate attitudes towards using and accessing ABs, and about 50% of the total participants showed low score of information regarding Abs resistance. In a similar study in UAE, among the university students, the studied population scored higher in attitude followed by knowledge and practice score. The mean attitude score was 76% likened to 59% on behalf of knowledge score then 45% on behalf of practice total score (Jairoun et al., 2019) which are nearly similar to our scores.

It was clear that the applicants stood confused about the allergic effect of the custom of ABs, since only 56.6% of them knew that Abs can cause allergic reaction may lead to death. This was in contrast with another previous study, where most of the applicants (81%) have respectable information around the allergic reactions of the antibiotics (Carlet et al., 2012). Moreover, our participants showed good information concerning the usage of Abs during pregnancy and breast-feeding, as 70.6% of them knew that it's dangerous to use Abs during pregnancy and 62.8% knew that Abs are not safe during breastfeeding. However, almost 60% of the applicants lacked the information about safe practice of Abs on children's teeth. These findings stand higher than the records of (Al-Shibani et al., 2017).

As resistance to Abs were interconnected to levels of consumption and misuse and according to the well-known fact that the uncontrolled use of Abs could lead to adverse effects and prevalence of resistant microbial strains, it was important to ask about the participants' knowledge about such important information (Bell et al., 2014 & Abdulhak et al., 2011). Only 59.3% of our participants had information about Abs resistant problem, which is unsatisfactory result. Similarly, in Shehadeh et al., (2012) adults showed significant misuse and inadequate information concerning the effectiveness and resistance of ABs. deficiency of information regarding Abs resistant problem, safe practice of Abs on children's teeth and ABS related allergy could be due to lack of regular contact with physicians, gaining of Abs from pharmacists without asking about the usages also side way properties and absence of community health education programs.

The existing research revealed good results regarding the source of ABs, as only 10.9% of the applicants reported self-prescription of ABs, 5.2% reported pharmacist consultation, 5.4% reported family member advice and 78.5% reported the doctor's prescription as a source of antibiotics using. In another study in Riyadh, totally different results were obtained, as they revealed increased use (69.7%) of self-prescribed Abs and patients getting Abs without physician's consultation directly from pharmacy (Al-Shibani et al., 2017). This may be because Abs can be bought without a medical prescription by the physician in Saudi Arabia, which is alerting to the comparative significance of over-the-counter sales and pharmacists' attitude towards Abs should be investigated (Abdulhak et al., 2011 & Al Rasheed et al., 2016).

A unique imperative factor as regards the general adult use of Abs is when to discontinue the Abs intake. In our study, 45.1% of the contributors stop using the Abs just after feeling better; however, in Al-Shibani et al., (2017) more than half of the contributors (67%) discontinues therapy after improvement of their symptoms. This was a misconception and result in further ABs resistance and deterioration of disease. In a previous study done by Cizman, (2003) they reported left-over use, incorrect dosage, and early therapy discontinuation as well-recognized attitudes related to Abs compliance and misuse. Similarly, the findings displayed that compliance is generally unsatisfactory as regards to complete Abs coverage among adult population.

We found a significant relation between knowledge score and marital status, degree of education and frequency of Abs intake with P value= (0.015, 0.000, 0.004) respectively, however the significant relation with attitude was recorded to be with nationality, education, frequency of Abs intake in addition to source of Abs with P value= (0.030, 0.000, 0.000, 0.000) respectively, which is different than the significant relations obtained between knowledge and socio-demographics in Al-Shibani et al., (2017), they

reported a significant relation concerning information and each of ABs source, reason of antibiotics intake and time of stopping of antibiotics using with P value= (0.026, 0.038, 0.021) respectively.

## 5. CONCLUSION

The existing article showed a relatively good information score and bad attitude regarding the safe use of Abs among the population. Study results revealed good results regarding the source of antibiotics and self- medication. Increasing the awareness of the community concerning the Abs usage and drug resistant strains is highly needed.

### Informed consent

Informed consent was obtained from all participants included in the study.

### Ethical Consideration

The study was approved by the Research Ethics Committee of the General Directorate of the Health Affairs of the Northern Border Region of Saudi Arabia; Program of the Saudi Board of Family Medicine in the Northern Borders with Ethical approval number (1166155) at 10/6/1441.

### Acknowledgement

The authors would like to thank Abdalla Mohamed Bakr Ali, Faculty of Medicine, Sohag University for his assistance in different steps of data management and statistical analysis.

### Author Contributions

All the authors contributed evenly with regards to data collecting, analysis, drafting and proofreading the final draft.

### Funding

This study has not received any external funding

### Conflict of Interest

There are no conflicts of interest.

### Data availability

All data associated with this study are present in the paper.

## REFERENCES AND NOTES

1. Abdulhak AA, Al Tannir MA, Almansor MA, Almohaya MS, Onazi AS, Marei MA, et al. Non prescribed sale of antibiotics in Riyadh, Saudi Arabia: a cross sectional study. *BMC Public Health* 2011; 11: 538.
2. 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.
3. Al-Ahmadi S, Al-Hindi Y. Investigating the appropriateness of antibiotic usage and misuse for uncomplicated urinary tract infections (UTIs) in the clinics at King Abdul-Aziz Hospital (KAH) in Makkah, Kingdom of Saudi Arabia. *Med Sci* 2020; 24(105): 3485-3493
4. Alanazi A, Almudhaibery F, Almamary A. Non- prescribed antibiotics consumption in children in Riyadh city, Saudi Arabia. *J Pharm Pharm Sci* 2013; 29: 806-813.
5. Al-Bakri AG, Bustanji Y, Yousef AM. Community consumption of antibacterial drugs within the Jordanian population: sources, patterns and appropriateness. *Int J Antimicrob Agents* 2005; 26(5):389-95.
6. Al-Shibani N, Hamed A, Labban N, Al-Kattan R, Al-Otaibi H, Alfadda S. Knowledge, attitude and practice of antibiotic use and misuse among adults in Riyadh, Saudi Arabia. *Saudi Med J* 2017; 38(10):1038–44.
7. Alumran A, Hurst C, Hou XY. Antibiotics overuse in children with upper respiratory tract infections in Saudi Arabia: Risk factors and potential interventions. *Clin Med* 2011; 1: 8-16.
8. Awad AI, Aboud EA. Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PLoS One* 2015; 10: e0117910
9. Bell BG, Schellevis F, Stobberingh E, Goossens H, Pringle M. A systematic review and meta-analysis of the effects of

- antibiotic consumption on antibiotic resistance. *BMC Infect Dis* 2014; 14:13.
10. Carlet J, Jarlier V, Harbarth S, Voss A, Goossens H, Pittet D. Ready for a world without antibiotics? The penicillin antibiotic resistance call to action. *Antimicrob Resist Infect Control* 2012; 1:11.
  11. CDC. Antibiotic Resistance Threats. Cdc. 2013;22–50. <https://www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf>
  12. Cebo-tarenco N, Bush PJ. Reducing antibiotics for colds and flu: a student-taught program. *Health Educ Res* 2008; 23(1):146-57.
  13. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J psychol med* 2013; 35(2):121.
  14. Cizman M. The use and resistance to antibiotics in the community. *Int J Antimicrob Agents* 2003; 21:297–307.
  15. Davey P, Brown E, Charani E, Fenelon L, Gould IM, Holmes A, Ramsay CR, Wiffen PJ, Wilcox M. Interventions to improve antibiotic prescribing practices for hospital inpatients. *Cochrane Database Syst Rev* 2013; (4):CD003543.
  16. Donkor ES, Tetteh-Quarcoo PB, Nartey P, Agyeman IO. Self-medication practices with antibiotics among tertiary level students in Accra, Ghana: a cross-sectional study. *Int J Environ Res Public Health* 2012; 9(10):3519-3529.
  17. Gebeyehu E, Bantie L, Azage M. Inappropriate use of antibiotics and its associated factors among urban and rural communities of Bahir Dar city administration Northwest Ethiopia. *PLoS One* 2015; 10:1-14.
  18. Hyun DY, Hersh AL, Namtu K, et al. Antimicrobial stewardship in pediatrics: How every pediatrician can be a steward. *JAMA Pediatr* 2013; 167: 859-866.
  19. Jairoun A, Hassan N, Ali A, Jairoun O, Shahwan M, Hassali M. University students' knowledge, attitudes, and practice regarding antibiotic use and associated factors: a cross-sectional study in the United Arab Emirates. *Int J Gen Med* 2019; 12:235-246.
  20. Mora-Cancino AM, Hernández-Valencia M. Embarazo en la adolescencia. *Ginecol Obstet Mex* 2015; 83(5):294–301.
  21. O'Neill J. Review on antimicrobial resistance antimicrobial resistance: tackling a crisis for the health and wealth of nations. London: Review on Antimicrobial Resistance; 2014.
  22. Pechère JC. Patients' interviews and misuse of antibiotics. *Clin Infect Dis* 2001; 33Suppl 3:S170-3.
  23. Ramchurren K, Balakrishna Y, Mahomed S. Patients' knowledge, attitudes and practices regarding antibiotic use at a regional hospital in KwaZulu-Natal, South Africa 2017. *South African J Infect Dis* 2018; 0(0):1-6.
  24. Roberts RR, Hota B, Ahmad I, Scott RD 2nd, Foster SD, Abbasi F, Schabowski S, Kampe LM, Ciavarella GG, Supino M, Naples J, Cordell R, Levy SB, Weinstein RA. Hospital and societal costs of antimicrobial-resistant infections in a Chicago teaching hospital: implications for antibiotic stewardship. *Clin Infect Dis* 2009; 49(8):1175-84.
  25. Rubin MA, Samore MH. Antimicrobial Use and Resistance. *Curr Infect Dis Rep* 2002; 4(6):491-497.
  26. Shehadeh M, Suaifan G, Darwish RM, Wazaify M, Zaru L, Alja'fari S. Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan. A pilot study. *Saudi Pharm J* 2012; 20: 125-133.