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Full Length Research Paper

A cross-sectional study on knowledge, attitude and behavior related to antibiotic use and resistance among medical and non-medical university students in Jordan

Ghadeer A. R. Y. Suaifan[1]*, Mayadah Shehadeh[1], Dana A. Darwish[2], Hebah Al-Ijel[1], Al-Motassem M. Yousef[3] and Rula M. Darwish[4]

[1]Department of Pharmaceutical Sciences, Faculty of Pharmacy, the University of Jordan, Amman, Jordan.
[2]Department of Pharmacology and Biomedical Sciences, Faculty of Pharmacy and Medical Sciences, Petra University, Amman, Jordan.
[3]Department of Biopharmaceutics and Clinical Pharmacy, Faculty of Pharmacy, the University of Jordan, Amman, Jordan.
[4]Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, the University of Jordan, Amman, Jordan.

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Irrational antibiotics use is a major reason for the spread of antibiotic resistance. Earlier studies from Jordan indicated irrational antibiotic use among the public. Our aim is to evaluate the current knowledge, attitude and behaviour regarding antibiotic use and reasons for resistance development among university students in Jordan. A cross-sectional, questionnaire-based survey involving medical and non-medical students at the University of Jordan was conducted. Response rate was 85% and the majority of the sample was non-medical female students. Scoring level analysis revealed inadequate knowledge, high consumption rates and self-medication among students regardless of their specialty. Forty four percent of non-medical and 28.1% medical students agreed that antibiotics cure common colds and viral infections. Almost 61% of students did not complete their last course of antibiotic, 31.2% requested antibiotic prescriptions from clinicians and 37.5% were prescribed antibiotics over the phone. In conclusion, gaps in terms of knowledge, attitude and practice regarding antibiotics use among students were observed. National education programs should target these gaps aiming at increasing awareness on proper antibiotics use and its association with drug resistance. Enforcing antibiotic regulations at a national level is paramount targeting over the counter sale hence, reducing self-medication and high rates of consumption.

Key words: Antimicrobial resistance, prescribing practice, health education.

INTRODUCTION

Irrational use of antibiotics is a key reason for the increase and spread of antibiotic resistance (Gyssens, 2001; Nordberg et al., 2004; Srinivasan et al., 2004; Morgan et al., 2011). Several factors may enhance irrational antibiotics usage, which could be doctors' doctors' knowledge and experiences (Cetinkaya et al., 2010), diagnostic uncertainty, patients' expectations, lack of patient and health care professionals education, pharmaceutical marketing, antibiotic selling without a prescription as well as economic and political reasons (Orton, 2001; Oyetunde et al., 2010). Jordan has a low antibiotic prescription rate (Al-Azzam et al., 2007). Nonetheless, earlier studies indicated inappropriate prescribing and dispensing patterns (Al-Bakri et al., 2005; Al-Azzam et al., 2007; Sawair et al., 2009a). Clinicians'

*Corresponding author. E-mail: gh.suaifan@ju.edu.jo. Tel: 00962 6 5355000 ext. 23312. Fax: 00962 6 5339998.

Table 1. Demographic characteristics of the 679 respondents in Jordan.

Gender	Number	Percentage
Age		
18-25	658	96.9
26-35	14	2.1
> 35	7	1.0
Marital status		
Single	652	96.0
Married	23	3.4
Divorced	4	0.6
College type		
Medical	200	29.5
Non-medical	479	70.5
Place of living (676) [a]		
Capital (Amman)	472	69.8
All other cities	204	30.2

[a] Total number < 679 due to unanswered questions/missing data,

prescribing practices are varied (Al-Momany et al., 2009; Dar-Odeh et al., 2010; Shehadeh et al., 2011) and governmental regulations that prohibit selling of antibiotics without a prescription are not fully enforced (Yousef et al., 2008; Albsoul-Younes et al., 2010). Moreover, misuse of antibiotics in treating viral infections is common and the prevalence of self-medication is alarmingly high (Al-Azzam et al., 2007; Sawair et al., 2009a). Hence, the need to further explore and tackle the vital issue of antibiotics misuse is evident.

One of the important strategies to control antibiotic resistance is tailored educational interventions directed at patients (Finch et al., 2004; Arnold and Straus, 2005). Changing patients' beliefs about the appropriate use of antibiotics was shown to control their unnecessary use (Wutzke et al., 2007).

The aim of this study was to evaluate the current knowledge, attitude and behavior regarding antibiotics use among students at the University of Jordan (UOJ). Also to identify the gaps in the knowledge and practice of tackling self-medication and the abuse of antibiotics.

MATERIALS AND METHODS

The study population

The study population was the UOJ students whose number amounted to nearly 31,855 students in 2010, out of which 7748 are medical and 24107 are non-medical. The target study sample was divided into two groups, A and B. Group A included students from medical and health science disciplines (Medicine, Dentistry, Pharmacy, Nursing and Rehabilitation Sciences), which was designated as "Medical" group; whereas, Group B represent the 'non-medical' group, which included students from all other specialties.

The study sample

A total of 800 questionnaires were distributed by trained research assistants. The questionnaires were handed to students at the beginning of different classes after obtaining the instructors' permission. Completed anonymized questionnaire were returned at the end of the class. The study was carried out during the month of November 2010.

The study tool: The questionnaire

A structured questionnaire was developed by reviewing relevant literature and questionnaires used previously in similar studies (Buke et al., 2005; Chen et al., 2005; You et al., 2008; McNulty et al., 2007a; McNulty et al., 2007b). An expert committee of two clinical pharmacists, one statistician and one sociologist designed the questionnaire and tailored it to the Jordanian setting to assure its applicability. The questionnaire was translated into Arabic. The validity of the translation was assured by consulting with personnel who are fluent in both languages. Furthermore, it was field-tested several times on a pilot sample of 40 students (5% of the target sample) to clarify any ambiguities.

The questionnaire comprised a total of 31 questions divided into five sections. The first section covered participants' demographic data such as sex, marital status, age, type of college and place of residence (Table 1). The second section involved the source of antibiotics used by the participants and the frequency of antibiotic use over the past year. The third section assessed students' knowledge on the purpose of using antibiotic (bacterial infection, viral infection, common cold, pain, fever and stomachache), antibiotic efficacy, safety and reasons leading to antibiotic

Table 2. The knowledge of respondent regarding antibiotic use.

Statements evaluating indication and efficacy of antibiotics	Medical			Non-Medical			*P*
	Number	Total*	Percent	Number	Total*	Percent	
(A) The antibiotic is use for							
Bacterial infection[1]	140	199	70.4	140	469	29.9	< 0.001
Viral infection[2]	55	196	28.1	307	457	67.2	< 0.001
Common cold, cough and nasal congestion[2]	86	197	43.7	288	459	62.8	< 0.001
Analgesic[2]	14	199	7.0	103	470	21.9	< 0.001
Fever[2]	44	198	22.2	172	462	37.2	< 0.001
Stomach ache[2]	55	197	27.9	162	463	35.0	0.212
(B) An antibiotic will always be effective in the treatment of same infection in the future[2]	50	197	25.4	172	461	37.3	0.003
(C) Antibiotic resistance is due to:							
Using antibiotics when they are not necessary[1]	153	191	80.1	297	394	75.4	< 0.001
Not completing the full course of antibiotic[1]	161	191	84.3	306	395	77.5	< 0.001
Using antibiotic without physician prescription (Self medication) [1]	132	186	71.0	248	384	64.6	< 0.001
Using the same antibiotic with a different brand[2]	99	181	54.7	207	370	56.0	< 0.001
(D) Antibiotic safety							
Antibiotic might develop allergy leading to death[1]	156	197	79.2	255	462	55.2	< 0.001

* Total percentage denotes those who answered the question and agreed with the statement. [1], Statements awarded students one point in scoring the level of knowledge upon agreement; [2], Statements deduced students one point in scoring the level of knowledge upon agreement.

resistance (e.g. unnecessary use, not completing the course, self-medication, drug-drug interaction and using different antibiotic brands) (Table 2). The fourth section examined students' attitude and behavior regarding antibiotics use and level of self-medication (Table 3). Finally, the fifth section enquired about the clinician-patient relationship/interaction in terms of antibiotic prescribing e.g. requesting antibiotics from clinicians or consulting other clinicians to obtain an antibiotic, over the phone prescribing and patients' perceptions on the appropriateness of antibiotic prescribing by their clinicians (Table 4).

Questions to determine the level of knowledge (n = 12) were stated as "agree", "disagree" or "I do not know". Whereas, questions on participants' attitude, behavior and patient-clinician interaction were either a yes/no questions (n = 14) or multiple choice types (n = 5).

Data analysis

All data were coded, entered, and analyzed using Statistical Package for Social Sciences program (SPSS), version 16.0. The level of knowledge among participants (examined by 12 questions, Table 2) was determined using the Isacson and Bingefors scoring method (Isacson and Bingefors, 2002). Agreement with some statements and disagreement with another were believed to be the correct answer as identified in Table 2. The analysis excluded those who answered 6 or less out of the 12 knowledge assessment questions (considered missing data).

One point was given for each correct answer, one point was deducted for each wrong answer, whereas the answer 'I do not know' did not affect the grade. Respondents with a total score of 7 or above were considered to have good knowledge, while those with a total score of 6 or below were considered to have poor knowledge (Sawalha, 2008a; Sawalha et al., 2008b).

The analysis of answers for other questions involved descriptive quantitative statistics e.g. frequency and percentage. Chi-square and Fisher exact tests were used to test for significant association between groups ($p < 0.05$).

RESULTS

Characteristics of the study population

Out of the 800 questionnaires distributed, 679 were returned (response rate = 84.9%). The majority of respondents (97%) were between 18 to 25 years old. Females constituted 60.5% of sample and 70.5% of respondents were students of the non-medical faculties (Table 1). Most respondents (69.8%) lived in the capital

Table 3. Attitude and behavior towards antibiotic use among respondents.

Statements evaluating attitude and behavior	Number	Total	Percent*
Respondents follow clinician instruction when prescribed antibiotics	435	667	65.2
Respondents reduce the dose of antibiotics without consulting their clinician	37	667	5.5
Respondents use antibiotics in irregular pattern	75	668	11.2
Respondents stopped antibiotics use without consulting their clinician	77	663	11.6
Respondents who did not complete their last course of antibiotics	405	662	61.2
Reasons stated by respondents not completing their last course of antibiotics:			
Antibiotic pack finished	22	279	7.9
Felt better	165	279	59.1
Forgot/could not be bothered	40	279	14.3
Antibiotics proved ineffective	12	279	4.3
Stopped based on physician request	18	279	6.5
Side effect/antibiotics made me feel unwell	16	279	5.7
Lost of antibiotics	18	279	6.5
Respondents who kept left-over antibiotics	462	632	73.1
Reasons given by respondents for keeping left-over antibiotics:			
In case needed again	286	450	63.6
Left-over/did not complete the course	33	449	7.3
Prescribed by clinician for future use/stand by	31	450	6.9
No apparent reason/just kept the antibiotics	38	449	8.5
Unsure how to dispose it	14	449	3.1
Laziness	36	449	8.0
Recurring infection	31	450	6.9
Other reason	10	449	2.2
Origin of left-over antibiotics used by respondents admitted self medication:			
Originally prescribed for the same infection	349	612	57.0
Originally prescribed for another type of infection	43	615	7.0
Originally prescribed for another family member	144	615	23.4
Originally prescribed for a non-family member infection	56	615	9.1
From abroad without prescription	13	615	2.1
Reason given by respondents for using left-over antibiotics:			
Throat infection including tonsillitis	176	621	28.3
Flu/cold/cough	258	621	41.5
Gum/tooth infection	34	621	5.5
Urinary Tract Infection	50	622	8.0
Ear/sinus infection	34	621	5.5
Infection of skin	18	621	2.9
Other	0	0	0

* Total percentage denotes those who answered the question and agreed with the statement.

city, Amman. The demography of our study sample in terms of gender and specialty reflected those of the study population. Almost two third (65.3%) of students registered at UOJ in 2010 were females, and 13 out of the 18 academic specialties offered by the UOJ were non-medical.

Antibiotic procurement and frequency of use

Sixty four percent (63.9%) of respondents took antibiotics on an outpatient basis during the past year. The frequency of antibiotic use was once, twice, thrice and more than three times during the same period

Table 4. Patient-clinician interaction.

Parameter	Number	Total	Percent*
Respondents requesting antibiotic prescriptions from their physicians	206	660	31.2
Respondents consulting another physician to prescribe antibiotics if their physician disagreed to do so	171	662	25.8
Physicians routinely prescribed antibiotics to treat common cold symptoms	249	664	37.5
Physicians prescribing antibiotics over the phone without examining the patient	181	665	27.2

*Total percentage denotes those who answered the question and agreed with the statement.

representing 21.0, 32.9, 19.6 and 24.9% of respondents, respectively. Antibiotics were used more frequently by medical (72.5%) than non medical (61.5%) students (p = 0.003). More than half of the respondents (52.7%) who used antibiotics in the past year purchased them from retail pharmacies using a clinician's prescription, while 27.7% purchased them from pharmacies without a prescription; 13.2% used left-over antibiotics, and 5.3% got them from other sources such as friends. No significant difference was observed between medical (29.0%) and non-medical students (27.1%) in terms of self- medication and the purchase of antibiotics without a prescription.

Respondents knowledge of antibiotics

Knowledge of antibiotic efficacy, safety and resistance

Confusion regarding whether antibiotics were effective against bacteria or viruses was clear. Seventy percent (70.4%) of medical students and 29.9% of non-medical students (p < 0001) knew that antibiotics were indicated to treat bacterial infections. Almost seventy percent (67.2%, CI 70.4 to 64.0%) of non-medical students agreed that antibiotics can be used to treat viral infections and 62.8% believed that they can be used for common cold (Table 2).

Eighty percent (80.1%) of medical students and 75.4% of non-medical students (p < 0.001) believed that antibiotic efficacy is undermined by their misuse (using antibiotics when unnecessary) (Table 2). Moreover, 84.0% of students believed frequent inappropriate antibiotic use was detrimental to health.

Only 23.0% of all respondents demonstrated good level of knowledge based on Isacson and Bingefors criteria. Of these, 43% were medical students and 8% were non-medical students (p < 0.001). Level of knowledge also varied significantly with gender (p = 0.033) as 26.5% of females and 14.2% of males were found to have good levels of knowledge.

Knowledge of antibiotic safety

Medical respondents were more knowledgeable about antibiotic safety compared to non-medical ones. Almost eighty percent (79.2%) of medical students were aware of the possible death due to antibiotic allergy compared to 53.5% of non-medical students (p < 0.001).

Almost one in every five females (22.8%) and one in every four of males (28.8%) agreed that antibiotics were generally safe to use during pregnancy. Similarly, 22.3% of females and 29.5% of males agreed that antibiotics were safe during breast feeding.

Respondents attitudes and behaviors towards antibiotic use

Patterns of antibiotic use

Our study indicated that 65.2% of respondents who were prescribed an antibiotic in the past year did not complete their treatment course. The reasons for this were variable (Table 3) and a significant difference (p = 0.001) was found in the behavior between medical and non-medical students. Eighty percent of non-medical students did not complete the full course of antibiotics compared to 50.3% of medical respondents. Ironically, 84.6% of respondents who did not complete their course agreed that an antibiotic regimen should always be completed.

Inconsistency in use of antibiotics was also noticed. Almost one third of the respondents (34.8%) did not take their antibiotics regularly and 5.5% reduced the dose without consulting their clinicians.

Self-medication and purchasing antibiotics without consulting a clinician did not significantly differ (p = 0.472) between students with poor level of knowledge (24.6%) and those with good levels (21.8%).

Handling left-over antibiotics

Two third of respondents (73.1%) reported keeping left

over antibiotics. Several reasons were behind keeping antibiotics as well as the means by which they were obtained (Table 3). Antibiotics were used to treat an array of health conditions, primarily throat infection including tonsillitis (Table 3).

Clinicians' prescribing practices and patient-clinician interaction

Almost one third (31.2%) of respondents requested an antibiotic from their clinicians. Furthermore, 25.8% of respondents sought other clinicians to prescribe antibiotics when their primary clinician did not do so.

On the other hand, antibiotics were prescribed by clinicians to treat common cold symptoms as reported by 37.5% of respondents. In addition, 27.2% of the respondents had antibiotics prescribed to them over the phone without being physically examined (Table 4).

DISCUSSION

The uncontrolled use of antibiotics is a well-established reason for antibiotic resistance due to the emergence of virulent strains of resistant microbes, which seriously jeopardizes health (Austin et al., 1999; Linares, 1998; Hawkey, 1998; Steinke and Davey, 2001). Interestingly, our study sample mostly agreed that overuse of antibiotics decreased their efficacy and increased tendency for resistance. Nonetheless, the knowledge and attitude of our respondents did not necessarily reflect on their behavior. This was evident by the high rate of consumption of antibiotics among students, as well as their self-medication, and irregular patterns of antibiotic use.

The high rate of antibiotic use and self-medication seen in this study could partly be explained by the students' desire to have a quick relief from illness. However, it is worthy to mention that the 28% self-medication observed in our study was lower than that reported in other studies from Jordan. In two previous studies, 40.7% of Jordanians attending a department of dentistry and 46.0% of a sample of consecutive customers arriving at community pharmacies in Amman sought antimicrobials without a prescription (Sawair et al., 2009b; Al-Bakri et al., 2005). Another predominant factor that could explain self-medication is economic, that is, to save the clinicians' fees. Moreover, the lack of enforcement of drug regulations, which prohibit the purchase of antibiotics without a prescription is a prime determinant of their prevalent over and misuse.

Self-medication did not differ among students being of medical or non-medical background, which was similarly reported in previous studies by James et al. (2006). Even in studies where medical students recorded lower rates of antibiotic consumption, the researchers still found that their use of antibiotics was irrational and that their knowledge did not correlate well with their behavior (Buke et al., 2005).

Generally, patients' perceptions of antibiotic effectiveness influence their interaction with health care professionals. In this study, students requested antibiotic prescription from their clinicians and sought others to do so, even in conditions that did not warrant the use such as cold and cough. This behavior was explained by their knowledge since they believed that antibiotics were of value in such cases. The misconceptions and confusion regarding the indications of antibiotics use, whether bacterial or viral infections seen in our study conforms to other reports in the literature by Mckee et al. (1999) which showed that a majority of their study sample did not realize the difference between bacteria and viruses and believed that antibiotics worked against both. Hence, indications for use of antibiotics should be among the main issues highlighted in patient education activities.

Our findings of sore throat infections and tonsillitis being the most common causes for using left-over antibiotics mimicked reports of health conditions associated with high rates of inappropriate self-medication from other parts in the world (Jaquier et al., 1998; James et al., 2006).

Although there is abundant evidence that antibiotics do not alter the course of the common cold, the majority of clinicians acknowledge that antibiotics were prescribed too often in such conditions (Mainous et al., 1996; Stott, 1979; Whitfield and Hughes, 1981; Little et al., 1997). In our study, the clinicians prescribed antibiotics to treat common cold, which would misguide students and put them at unnecessary risk for contracting infections with resistant pathogens.

Prescribing antibiotics over the phone reported in our study did not comply with good patient care. Not having patients physically examined would deprive the clinicians from valuable diagnostic clues and sound evaluation of the patients' conditions. Therefore, educational campaigns should target the need for changing prescribing practices and correcting patients' expectations from antibiotics as well as raising the awareness about resistance issues.

Limitations of the study

Some researchers have shown that respondents of questionnaire-based studies tend to underestimate the real situation (Meding and Barregard, 2001), which could limit the generalizability of our findings and their extrapolation to other settings without further research. Recall bias was possible because the period of time in question was one full year. However, two validity and reliability questions were inserted in the manuscript. The validity questions were both positive and negative. Students' answers were validated by these questions.

Additionally, the fact that the cutoff point used in determining the level of knowledge in this study was adopted from the Swedish setting and its applicability in the Jordanian one has been addressed. The same cutoff point we used was successfully implemented in other settings of a very close cultural make up as that of Jordanian society by Sawalha (2008) and Sawalha et al. (2008).

CONCLUSION AND RECOMMENDATIONS

This study showed that there is a need for education programme targeting Jordanian students addressing antibiotics use. It seems prudent to incorporate elective courses on antibiotics proper use and misuse into non-medical college's curriculum and to conduct follow up studies to ensure that our goal of reducing improper use of antibiotics has been fulfilled. Additional, education campaigns should be directed towards changing the public attitude and behavior to rationalize antibiotic use and limit self-medication and over use. On the other hand, clinician should also be targeted by these campaign since unfortunately, a previous survey study in Turkey indicated that one in every five (22.7%) pediatricians attended the 45th Turkish Congress of Pediatrics between June 17 to 20, 2009 in Turkey did resort to antibiotics when facing flu and common cold themselves (Cetinkaya et al., 2010). This unexpected practice should be addresses in future campaign. Furthermore, strict policies must be enforced to regulate procurement of antibiotics and prohibit their purchase without a prescription. Moreover, successful implementation of antibiotic regulations can involve urging pharmacists to dispense antibiotics on unit-dose basis rather than selling a whole drug pack.

Finally, consultation strategies and guidelines which make patient expectations explicit without damaging clinician-patient relationship should be followed.

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