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Prevalence of inappropriate use of antibiotics among university students in Asir region of Saudi Arabia

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ABSTRACT

Inappropriate use of antibiotics can produce harmful effects on the society as well on the individuals. Self-medication with antibiotics leads to antibiotic resistance and many other health hazards. Antibiotic resistance is rising to dangerously high levels in all parts of the world and inappropriate use is identified as the key reason. Hence, a descriptive study was conducted using self-administered questionnaire among 400 conveniently selected students from different colleges in Asir region. The questionnaire contained 23 questions about the socio-demographic background and prevalence of antibiotic use.To assess the level of inappropriate use of antibiotics, six key questions were selected and scores were given to each respondent based on their response for these questions. The total score was calculated and categorized under proper use (score 4-6) or improper use (score 0-3). Data was analysed using SPSS version 23 and Chi square test was applied to determine the significance.The researchrevealed that more than half of the sample used antibiotics for various illnesses. The illness for which antibiotic was used the most was sore throat. It was also observed that more than two third of the sample had used antibiotics without prescription and nearly half of the sample had used antibiotics for 3 days or less. More than one quarter of sample had used OTC antibiotic many times in the previous year. The study revealed alarmingly high percentage of university students, inappropriately using antibiotics. High prevalence of inappropriate use was observed among the students who were enrolled in health sciences.

INTRODUCTION

Antibiotics are medicines used to prevent and treat bacterial infections. Inappropriate use of antibiotics can lead to antibiotic resistance which in turn results in higher medical costs, prolonged hospital stays, and increased mortality [1]. Self-medication with antibiotics, in which antibiotics are used without medical consultation, can easily lead to their inappropriate use, yet this practice is highly prevalent in developing countries [2]. The practice that constitutes antibiotic misuse ranges from administration of antibiotics for viral infections, stopping therapy mid-way, saving prescribed antibiotics for future use etc [3].

Self-medication with antibiotics has the potential to produce harmful effects on the society as well on the individuals. In developing countries, self-medication is reported to be high. This may be due to the fact that antibiotics can be obtained from pharmacies without a prescription, due to the failure in strict implementation of law. In addition to this, antibiotics may also be procured from friends, relatives or even from the left over of a previous course [4]. In addition to antibiotic resistance; overusing antibiotics can lead to other problems. Antibiotics kill many different bacteria; even the good ones that help keep the body healthy. Sometimes taking antibiotics can cause a person to develop diarrhea due to a lack of good bacteria that help digest food properly. In some cases, bad bacteria, like *Clostridium difficile*, may overgrow and cause infections. In addition, inappropriate antibiotic use in pregnant and pediatric population can have more serious consequences. Eg: Tetracyclines in pregnancy [5].

It has been reported that increased risk of college students for respiratory infections accompanied by busy work, school, and social schedules fuel the desire for a quick remedy, often in the form of an antibiotic. Students may seek out healthcare after just a few hours of symptoms and are not aware of over-the-counter or comfort remedies they can try on their own [6].Few studies have been conducted on the level of inappropriate use of antibiotics among university students in various countries. Nevertheless, very limited data is available about the misuse of antibiotics and their associated risk factors among the above mentioned population in Saudi Arabia.

The present study is aimed at assessing the prevalence of inappropriate use and the association of various risk factors among university students in Khamismushayt, Saudi arabia.

MATERIALS &METHODS

Study design

A descriptive cross sectional study in which pre validated, self administered questionnaire was distributed to 400 conveniently selected university students attending female colleges in Asir region of Saudi Arabia was performed.The study was conducted at college of arts and science, college of applied medical sciences and community college under King Khalid University, KhamisMushayt, during a 16-week period from January 2019 to April 2019. Inclusion criterion was female students enrolled in the above mentioned colleges during the period of study. Those who were unwilling to participate in the study were excluded. The investigating intern has taken written consent from the respondents, prior to the data collection and explained the purpose of the study.Upon completion of the questionnaire, the respondents were advised briefly on the safe use of antibiotics. Ethical approval was obtained from King Khalid University ethical committee and from the colleges where data collection had taken place.

Data collection

Data were collected using a questionnaire that contained 23 questions written in Arabic language about the socio-demographic background and prevalence of antibiotic use. The questionnaire consisted of 2 parts. Part 1 was aimed at collecting the socio-demographic data of the respondents such as age, course enrolled, part time job, place of residence, family income, having a health professional in the family, part time job engagement, accessibility to health care system etc. In part 2, data regarding the pattern of antibiotic use was collected.

To assess the level of appropriate use/inappropriate use of antibiotics among the sample, six key questions were selected and scores were given to each respondent based on their response for these questions (Response indicating proper use -1 and response indicating improper use-0). The total score was calculated for all respondents and categorized under proper use (score 4-6) or improper use (score 0-3).

Statistical design:

The collected data was analyzed and tabulated by using SPSS (version .23.0) and Chi square test was applied to determine the significance. $p< 0.05$ was considered as the cut-off value for statistical significance.

RESULTS

Distribution of socio-demographic factors

Majority of sample were single (76.0 %), of family income 5000-10000 SAR (72.0 %) were enrolled in courses other than health sciences (71.3 %) and without part time job (79.3 %), More than half the sample belonged to the age group 21-24 (53.0 %), did not have a health care professional in their family (54.3 %) and were residents of big town (51.0 %). Data presented in Table 1.

Pattern of antibiotic use among university students

The research revealed high prevalence of inappropriate antibiotic use among the sample with regard to its procurement, duration of therapy, compliance with instructions for use etc. More than half the sample revealed that they used OTC antibiotics for every illness. The illness for which most people used antibiotic was sore throat (29.3 %) and fever (19.8 %). More than 40 % respondents obtained their antibiotics from sources other than prescription by a physician, which indicates that the law enforcement regarding antibiotics is not efficient enough in the country.More than one quarter of the sample opted to use OTC antibiotics to save the time and effort required for hospital visit (28.3 %). More than two third of the sample have used antibiotics for an inappropriate duration (67.8 %).About two third of the sample reported that they have used the same antibiotic OTC, for any subsequent illness (62.8 %). Majority of the respondents revealed that they strictly followed the instructions for antibiotic use (87.5 %) and more than two third of the sample reported that they take their antibiotic doses on time (67.5 %).About one quarter of the sample (23.5 %) reported that they terminated the antibiotic therapy if they missed one dose. More than two third (66.5 %) of the sample admitted that they get the antibiotics prescribed by demand to the physician. More than half the sample reported that they continued the therapy with same antibiotic, if the symptoms persisted (53 %). More than half the sample admitted that they have used antibiotics without prescription in the previous year (51.5 %) and among them, more than half have used it many times in the previous year (52.9 %). Nearly half the sample reported that their choice of antibiotic was based on the advice of the pharmacist (47.5 %) while more than a quarter of the sample revealed that their primary concern while choosing an antibiotic was its side effects (36.5 %). The pattern of antibiotic use is given in Table 2.

Association of pattern of antibiotic use with socio demographic variables

Association of pattern of antibiotic use with age of the sample

Age of the respondents was found to have significant association with the source of antibiotics ($p < 0.01$). It was observed that nearly two third of the sample in the age group of above 25 had procured their antibiotics through a physician, and this trend was found to decrease in the lower age groups. Similarly, there was significant association between the age of the respondents and OTC antibiotic use in the previous year ($p < 0.01$). Majority of the sample (62 %) has reported that they have not used OTC antibiotics in the previous year. More than one third of the sample in every age group has admitted to have used OTC antibiotics many times a year. Two third of the sample in every age group have stated that they have strictly complied with the dosage timing of the therapy. Majority of the sample have reported that their management of a missed antibiotic dose was by taking it at the time of next dose. Another important finding of the present study was that more than half the sample in all age groups had practiced insufficient duration of antibiotic therapy and this trend was most in the age group 17-20.

Table 1 : Distribution of socio-demographic characteristics among university students

Socio-Demographic characteristics	Frequency	%
Age group		
17-20	88	22.0
21-24	212	53.0
More than 24	100	25.0
Marital Status		
Single	304	76.0
Married	57	14.3
Divorced	39	9.8
Family Income		
<4000	48	12.0
5000-10000	288	72.0
>10000	64	16.0
Course Enrolled		
Health Sciences	115	28.8
Others	285	71.3
Job Engagement		
Has part time job	83	20.8
No job	317	79.3
Having health care professional in the Family		
Yes	183	45.8
No	217	54.3
Place of residence		
Big town	204	51.0
Small town	122	30.5
Village	74	18.5
Accessibility to health care system		
Good	164	41.0
Moderate	187	46.8
Poor	49	12.3

Table 2 : Pattern of antibiotic use among college students

Pattern of use	Frequency	%
Use OTC antibiotics for every sickness		
Yes	217	54.3
No	183	45.8
Choice of illness for using antibiotics		
Runny nose with cough	16	4.0
Headache	46	11.5
Body pain	41	10.3
Stomach upset	32	8.0
Vomiting	42	10.5
Nose congestion	27	6.8
Sore throat	117	29.3
Fever	79	19.8
Source of antibiotics		
Physician	229	57.25
Pharmacy	87	21.75
Left over of a previous prescription	63	15.75
Friends	12	3.0
Purchase through internet	9	2.25
Reason for obtaining antibiotic without prescription		
Low income	41	10.3
Low accessibility to clinic	46	11.5
Availability of left over antibiotics	69	17.3
Previous positive experience with OTC antibiotic	67	16.8
To save time and effort	113	28.3
Other reasons	64	16
Duration of antibiotic use		
Until the symptoms disappear	82	20.5
1-3 days	188	47.0
4-7 days	129	32.3
More than 7 days	1	0.3
Self medication with same antibiotics OTC for any subsequent illnesses		
Yes	251	62.8
No	149	37.3
Strict compliance with the instructions for antibiotic use		
Yes	350	87.5
No	50	12.5

Strictly follow time schedule for the antibiotic doses		
Yes	270	67.5
No	130	32.5
Management of a missed antibiotic dose		
Stop taking further	94	23.5
Omit the missed dose and continue from the next dose	61	15.3
Take the missed dose as soon as you remember	245	61.3
Procure antibiotics by demand from the physician		
Yes	266	66.5
No	134	33.5
Continuation of the same antibiotic after the prescribed period, in case the same symptoms persist		
Yes	212	53.0
No	188	47.0
Use of OTC antibiotic in the last year		
Yes	206	51.5
No	194	48.5
Frequency of OTC antibiotic use in the previous year (Out of 206)		
Once	52	25.24
Twice	58	28.15
Many times	96	46.6
Choice of OTC antibiotic is based on		
Advice of the pharmacist	190	47.5
Opinion of the family member	68	17.0
Opinion of the friend	25	6.3
previous experience	107	26.8
Website	10	2.5
Primary concern while buying antibiotics OTC		
Convenience of dosage	106	26.5
Side effect	146	36.5
Type of antibiotic	117	29.3
Cost	17	4.3
Brand	14	3.5

Table 3 : Association of antibiotic use pattern and age of the sample

Pattern of antibiotic use		Age			X^2	p
		17-20	21-24	>25		
Source of antibiotics	Physician	46(52.27%)	118(55.66%)	65(65%)	20.436	**0.009**
	Pharmacy	26(29.54%)	36(16.98%)	25(25%)		
	Left over	11(12.5%)	44(20.75%)	8(8%)		
	Friends	4(4.54%)	6(2.83%)	2(2%)		
	Internet	1(1.13%)	8(3.77%)	0		
Use of OTC antibiotic in the last year	Yes	49(55.6%)	119(56.1%)	38(38%)	9.734	**0.008**
	No	39(44.3%)	93(43.8%)	62(62%)		
Frequency of OTC antibiotic use last year	Once	9 (18.3 %)	34(28.5 %)	9 (23.6%)	3.118	0.538
	Twice	13(26.5 %)	32(26.5 %)	13(34.3%)		
	Many times	27(55.1 %)	53(44.5 %)	16(42.1%)		
Strict compliance with antibiotic dose timing	Yes	58(65.9 %)	145(68.3%)	67(67 %)	1.91	0.909
	No	30(34.1 %)	67(31.1%)	33(33 %)		
Management of missed dose of antibiotics	Stop taking further	19(21.5%)	55(25.9%)	20(20%)	2.563	0.635
	Take as soon as possible	14(15.91%)	34(16.03%)	13(13%)		
	Take at the next dose	55(62.5%)	123(58.01%)	67(67%)		
Duration of antibiotic therapy	Until symptoms disappear	24(27.2%)	42(19.8%)	16(16%)	8.597	0.198
	1-3 days	44(50%)	100(47.16%)	44(44%)		
	3-7 days	20(22.7%)	69(32.5%)	40(40%)		
	>7 days	0	1(0.47%)	0		

Association of pattern of antibiotic use with family income of the sample

Family income was a socio demographic variable that was found to have association with most aspects of antibiotic use among the sample. It was found to be significantly associated with the source of antibiotics ($p < 0.01$), majority of the sample in the medium income group have obtained it through physician (60.76 %). Family income had significant association with the use of OTC antibiotic in the previous year and its frequency. More than half the sample in the medium income group has reported to have not used OTC antibiotic in the previous year (51.04 %) while only a small share of this group (38.29 %) had used it many times. Majority of the sample in every income group have stated that they had strictly complied with the dose timing of the antibiotic therapy. Similarly, family income was also found to be significantly associated with the method for the management of a missed antibiotic dose ($p < 0.001$), where more than two third of the sample reported to have managed the missed dose by taking it at the time of next dose (67.3 %). Family income of the sample had significant association with the duration of antibiotic therapy ($p < 0.01$), about half the sample in the low income group had practiced ideal duration of antibiotic therapy (45.83 %).

Table 4 : Association of antibiotic use pattern and family income of the sample

Pattern of antibiotic use		Family income			X^2	p
		<4000	5000-10000	>10000		
Source of antibiotics	Physician	20(41.6%)	175(60.7%)	34(53.1 %)	23.506	**0.003**
	Pharmacy	13(27.0%)	57(19.79%)	17(26.56%)		
	Left over	12(25.0%)	46(15.97%)	5 (7.81 %)		
	Friends	0	7 (2.43 %)	5 (7.81 %)		
	Internet	3 (6.25 %)	3(1.04 %)	3(4.68 %)		
Use of OTC antibiotic in the last year	Yes	27(56.2%)	141(48.9%)	38(59.37%)	9.734	**0.008**
	No	21(43.7%)	147(51.0%)	26(40.62%)		
Frequency of OTC antibiotic last year	Once	2(7.40%)	43(30.49%)	7(18.42%)	14.770	**0.005**
	Twice	5(18.51%)	44(31.20%)	9(23.68%)		
	Many times	20(74.0%)	54(38.29%)	22(57.89%)		
Strict compliance with the antibiotic dose timing	Yes	31(64.5%)	191(66.3%)	48(75%)	2.010	0.366
	No	17(35.4%)	97(33.6%)	16(25%)		
Management of missed dose of antibiotics	Stop taking further	16(33.3%)	60(20.8%)	18(28.12%)	19.998	**0.000**
	Take as soon as possible	14(29.1%)	34(11.8%)	13(20.3%)		
	Take at the next dose	18(37.5%)	194(67.3%)	33(51.5%)		
Duration of antibiotic therapy	Until symptoms disappear	11(22.9%)	51(17.70%)	20(31.25%)	17.749	**0.007**
	1-3 days	15(31.2%)	145(51.34	28(43.75%)		
	3-7 days	22(45.8%)	92(31.94%)	15(23.43%)		
	> 7 days	0	0	1(1.56%)		

Association of pattern of antibiotic use with part time job engagementof the sample

Part time job engagement of the sample was found to have significant association with source of antibiotics ($p<0.01$), Use of OTC antibiotic in the previous year ($p<0.01$), management of missed dose ($p<0.001$) and duration of antibiotic therapy ($p<0.01$). It was observed that more than half the sample who had a part time job had procured their antibiotic from sources other than physician (50.7 %). About two third of the sample (65.0 %) in the group with part time job had used OTC antibiotic in the previous year. About one third of sample (30.12 %) having part time job had terminated the therapy in case of a missed dose while two third of the sample (66.87 %) without part time job had continued the therapy from the next dose. About three quarters of the sample without part time job had used antibiotic for an insufficient duration (71.28 %) while nearly half the sample with part time job had used it for ideal duration (45.78 %). It was also found that about half the sample from both groups (48.14 % -with part time job, 46.05 %- without part time job) had used OTC antibiotics many times in the previous year and majority of sample from both groups (61.44 % -with part time job, 69.08 %- without part time job) had practiced strict compliance with regard to antibiotic dose timings.

Association of pattern of antibiotic use with course enrolled

The course enrolled was found to have no association with

Table 5 : Association of antibiotic use pattern and part time job engagement

Pattern of antibiotic use		Part time Job engagement		X^2	P
		Yes	No		
Source of antibiotics	Physician	41(49.3%)	188(59.3%)	16.513	**0.002**
	Pharmacy	16(19.2%)	71(22.3%)		
	Left over	15(18.07%)	48(15.14%)		
	Friends	5(6.02%)	7(2.2%)		
	Internet	6(7.2%)	3(0.9%)		
Use of OTC antibiotic in the last year	Yes	54(65.0%)	152(47.9%)	7.710	**0.005**
	No	29(34.9%)	165(52%)		
Frequency of OTC antibiotics last year	Once	10(18.51%)	42(27.63%)	2.045	0.360
	Twice	18(33.33%)	40(26.31%)		
	Many times	26(48.14%)	70(46.05%)		
Strict compliance with antibiotic dose timings	Yes	51(61.44%)	219(69.08%)	1.750	0.126
	No	32(38.55%)	98(30.91%)		
Management of missed dose of antibiotics	Stop taking further	25(30.12%)	69(21.76%)	25.037	**0.000**
	Take as soon as possible	25(30.12%)	36(11.35%)		
	Take at the next dose	33(39.75%)	212(66.87%)		
Duration of antibiotic therapy	Until symptoms disappear	20(24.09%)	62(19.55%)	17.715	**0.001**
	1-3 days	24(28.91%)	164(51.73%)		
	3-7 days	38(45.78%)	91(28.70%)		
	>7 days	1(1.20%)	0		

most aspects of antibiotic use. However, it was found to be significantly associated with the compliance of dose timings ($P < 0.01$) and management of a missed dose ($P < 0.01$). About three quarter of the sample from non health sciences had complied with the dosage timings and nearly one quarter of the sample from health sciences had terminated the therapy when they missed a dose of antibiotic. It is interesting to observe that the sample from health sciences and non health sciences had comparable practice trends regarding antibiotics such as source of antibiotics (58.26 %, 56.8 %), use of antibiotic in the last year (51.3 %, 51.8 %), used OTC antibiotic only once in the last year (23.7 %, 25.8 %) and ideal duration of antibiotic therapy (33.9 %, 31.5 %).

Association of pattern of antibiotic use with having a health professional in the family

Having a health care professional in the family had significant

Table 6 : Association of antibiotic use pattern and course enrolled

Pattern of antibiotic use		Course enrolled		X^2	P
		Health sciences	Others		
Source of antibiotics	Physician	67(58.26%)	162(56.8%)	8.726	0.068
	Pharmacy	33(28.6%)	54(18.9%)		
	Left over	12(10.4%)	51(17.8%)		
	Friends	2(1.7%)	10(3.5%)		
	Internet	1(0.86%)	8(2.8%)		
Use of OTC antibiotic in the last year	Yes	59(51.30%)	147(51.5%)	0.002	0.960
	No	56(48.6%)	138(48.4%)		
Frequency of OTC antibiotic use last year	Once	14(23.7%)	38(25.8%)	3.414	0.181
	Twice	12(20%)	46(31.2%)		
	Many times	33(55.9%)	63(42.8%)		
Strict compliance with antibiotic dose timings	Yes	184(64.5%)	86(74.7%)	3.98	**0.048**
	No	101(35.4%)	29(25.2 %)		
Management of missed dose of antibiotics	Stop taking further	36(31.3%)	58(20.35%)	8.225	**0.016**
	Take as soon as possible	21(18.2%)	40(14%)		
	Take at the next dose	58(50.43%)	187(65.61%)		
Duration of antibiotic therapy	Until symptoms disappear	28(24.34%)	54(18.9%)	2.658	0.447
	1-3 days	48(41.7%)	140(49.12%)		
	3-7 days	39(33.9%)	90(31.5%)		
	>7 days	0	1(0.35%)		

association with the frequency of antibiotic use ($p<0.01$), management of missed dose ($p<0.05$) and duration of antibiotic therapy ($p<0.05$). More than one third of the sample with medical background in the family (37.61 %) had used OTC antibiotic many times in the previous year while more than half the sample without medical background had used it many times (56.7 %). More than half the sample with medical background (26.7 %) and more than two third of the sample without medical background (67.2 %) had managed the missed dose by continuing the therapy from the next dose time. It is noteworthy that more than one quarter of the sample with medical background (26.2 %) had used antibiotics only till the symptoms disappeared while only a small share of sample without medical background had done so (15.66 %). Having a health professional in the family had no association with other aspects of antibiotic use and had showed similar trends in source of antibiotics, use of OTC antibiotic in the previous year and compliance with dose timings.

Association of pattern of antibiotic use with place of residence of the sample

The place of residence was found to have significant association with source of antibiotic ($p < 0.01$) and duration of antibiotic therapy ($p < 0.05$). More than half the sample from all groups (big town, small town, and village) had procured their antibiotics through a physician (60.7 %, 50.8 %, and 58.1% respectively). More than half the sample from the village (58.1 %) had practiced insufficient duration of therapy (1-3 days), while less than half the sample form the other two groups had done so

Table 7 : Association of antibiotic use pattern and presence of health professional in the family

Pattern of antibiotic use		Health care professional in the family		X^2	p
		Yes	No		
Source of antibiotics	Physician	106(57.92%)	123(56.68 %)	1.464	0.833
	Pharmacy	41(22.4%)	46(21.19 %)		
	Left over	25(13.66%)	38(17.51 %)		
	Friends	6(3.27%)	6(2.76 %)		
	Internet	5 (2.73 %)	4 (1.84 %)		
Use of OTC antibiotic in the last year	Yes	97(53.0%)	109(50.2%)	0.306	0.580
	No	86(46.9%)	108(49.7%)		
Frequency of OTC antibiotic use last year	Once	13(13.40%)	39(35.77%)	14.391	**0.001**
	Twice	29(29.89%)	29(26.60%)		
	Many times	55(56.70%)	41(37.61%)		
Strict compliance with the antibiotic dose timings	Yes	127(69.39%)	143(65.8%)	0.554	0.457
	No	56(30.60%)	74(34.10%)		
Management of missed dose of antibiotics	Stop taking further	49(26.7%)	45(20.7%)	7.680	**0.021**
	Take as soon as possible	35(19.12%)	26(11.9%)		
	Take at the next dose	99(54.09%)	146(67.2%)		
Duration of antibiotic therapy	Until symptoms disappear	48 (26.2 %)	34(15.66%)	8.256	**0.041**
	1-3 days	81(44.26%)	107(49.3%)		
	3-7 days	53(28.96%)	76(35.02%)		
	More than 7 days	1(0.54%)	0		

(big town-44.6 %, small town-44.26 %). More than half the sample from big town had not used OTC antibiotic in the previous year (52.9 %) while more than half the sample from other two groups had used OTC antibiotics (small town -55.7 %, village-56.7 %). More than half the sample from the village had used OTC antibiotics many times in the previous year (57.1 %) although there is no significant correlation. Other aspects of antibiotic use among the three groups followed a comparable trend and did not have significant association.

Association of pattern of antibiotic use with marital status of the sample

Unlike the other socio-demographic variables, marital status did not have any association with any of the antibiotic use patterns. The trends in the various aspects of antibiotic use among various groups were more or less similar; nevertheless it was observed that majority of the married sample (70.1 %) had procured their antibiotics from the physician.

Table 8 : Association of antibiotic use pattern and place of residence

Pattern of antibiotic use		Place of residence			X^2	p
		Big town	Small town	Village		
Source of antibiotics	Physician	124(60.7%)	62(50.8%)	43(58.1%)	21.883	**0.005**
	Pharmacy	52(25.4%)	20(16.3%)	15(20.2%)		
	Left over	17(8.3%)	33(27.04%)	13(17.5%)		
	Friends	6(2.9%)	4(3.27%)	2(2.70%)		
	Internet	5(2.45%)	3(2.45%)	1(1.35%)		
Use of OTC antibiotic in the last year	Yes	96(47.05%)	68(55.7%)	42(56.7%)	3.307	0.191
	No	108(52.9%)	54(44.2%)	32(43.0%)		
Frequency of OTC antibiotic last year	Once	24(25%)	19(27.9%)	9(21.4%)	6.997	0.136
	Twice	28(29.1%)	21(30.8%)	9(21.4%)		
	Many times	44(45.8%)	28(41.17%)	24(57.1%)		
Strict compliance with the antibiotic dose timings	Yes	142(69.6%)	82(67.2%)	46(62.1%)	1.379	0.502
	No	62(30.39)%	40(32.7%)	28(37.8%)		
Management of missed dose of antibiotics	Stop taking further Take as soon as possible	45(22.05%) 22(10.78%)	30(24.59%) 27(22.13%)	19(25.6%) 12(16.2%)	9.439	0.051
	Take at the next dose	137(67.1%)	65(53.27%)	43(58.1%)		
Duration of antibiotic therapy	Until symptoms disappear	33(16.17%)	33(27.04%)	16(21.6%)	14.230	**0.027**
	1-3 days	91(44.6%)	54(44.26%)	43(58.1%)		
	3-7 days	79(38.0%)	35(28.68%)	15(20.2%)		
	> 7 days	1(0.49%)	0	0		

Association of socio-demographic factors with use of antibiotics

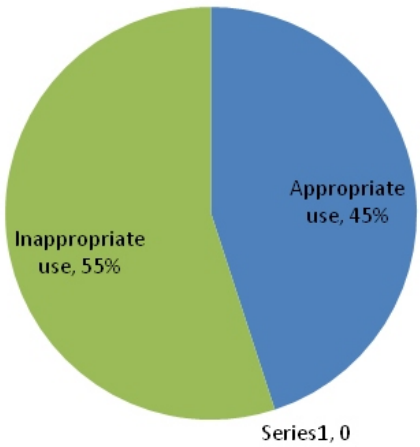
Inappropriate use of antibiotics among the sample was found to be significantly associated with age ($p<0.05$), high level being observed in the age group 17-20 (62.5 %). Inappropriate use was observed in more than half of the total sample (55 %)(Figure 1). Inappropriate use of antibiotics among the sample was found to decrease with increase in age. Other socio-demographic variables were found to have no significant correlation with the inappropriate use of antibiotics. Data represented in table 10.

DISCUSSION

Inappropriate use of antibiotics is the most important reason for the emergence and spread of resistance. In addition to resistance, this also can have deleterious effects in pregnant and lactating women. It is also established that inappropriate use of antibiotics can destroy the beneficial micro organism in the gastro intestinal tract [5]. Hence, it is important to establish safe use of antibiotics among the public and especially among the younger generation, as they are the future of the country.

Table 10 : Association of antibiotic use pattern and marital status of the sample

Pattern of antibiotic use		Marital status			X^2	p
		Single	Married	Divorced		
Source of antibiotics	Physician	166(54.6%)	40(70.1%)	23(58.9%)	6.714	0.568
	Pharmacy	70(23.0%)	9(15.78%)	8(20.51%)		
	Left over	51(16.7%)	5(8.77%)	7(17.94%)		
	Friends	10(3.28%)	2(3.50%)	0		
	Internet	7(2.30%)	1(1.75%)	1(2.56%)		
Use of OTC antibiotic in the last year	Yes	156(51.3%)	28(49.1%)	22(56.4%)	0.510	0.775
	No	148(48.2%)	29(50.87%)	17(43.58%)		
Frequency of OTC antibiotic use last year	Once	41(26.28%)	6(21.42%)	5(22.72%)	1.082	0.897
	Twice	42(26.92%)	10(35.71%)	6(27.27%)		
	Many times	73(46.79%)	12(42.85%)	11(50%)		
Strict compliance with antibiotic dose timings	Yes	211(69.4%)	37(64.91%)	22(56.41%)	2.865	0.239
	No	93(30.59%)	20(35.08%)	17(53.58%)		
Management of missed dose of antibiotics	Stop taking further	74(24.34%)	13(22.80%)	7(17.94%)	2.113	0.715
	Take as soon as possible	48(15.78%)	6(10.52%)	7(17.94%)		
	Take at the next dose	182(59.8%)	38(66.66%)	25(64.10%)		
Duration of antibiotic therapy	Until symptoms disappear	65(21.38%)	8(14.03%)	9(23.07%)	12.481	0.052
	1-3 days	146(48.0%)	26(45.61%)	16(41.02%)		
	3-7 days	93(30.59%)	23(40.35%)	13(33.33%)		
	More than 7 days	0	0	1(2.56%)		



Pic 1 : Prevalence of inappropriate antibiotic use among university students

Table 10 : Association of socio-demographic factors with inappropriate/appropriate use of antibiotics

Pattern of antibiotic use	Age			X^2	p
	17-20	21-24	More than24		
Inappropriate use	55(62.5%)	121(57.07%)	44(44%)		
Appropriate use	33(37.5%)	91(42.92%)	56(56%)	7.258	**0.027**
	Marital status			X^2	p
	Single	Married	Divorced		
Inappropriate use	172(56.57%)	28(49.12%)	20(51.28%)		
Appropriate use	132(43.42%)	29(50.87%)	19(48.71%)	1.320	0.517
	Family income			X^2	p
	<4000	5000-10000	>10000		
Inappropriate use	28(58.33%)	152(52.77%)	40(62.5%)		
Appropriate use	20(41.66%)	136(47.22%)	24(32.5%)	2.245	0.326
	Place of residence			X^2	p
	Big town	Small town	Village		
Inappropriate use	102(50%)	70(57.37%)	48(64.86%)		
Appropriate use	102(50%)	52(42.62%)	26(35.13%)	5.249	0.072
	Accessibility to health care system			X^2	p
	Good	Moderate	Poor		
Inappropriate use	86(52.43%)	103(55.08%)	31(63.26%)		
Appropriate use	78(47.56%)	84(44.91%)	18(36.73%)	1.788	0.409
	Course Enrolled			X^2	p
	Health sciences		Others		
Inappropriate use	67(58.26%)		67(58.26%)		
Appropriate use	48(41.7%)		48(41.7%)	0.693	0.405
	Job Engagement			X^2	p
	Has part time job		No part time job		
Inappropriate use	49(59.03%)		49(59.03%)		
Appropriate use	34(40.96%)		34(40.96%)	0.689	0.408

The present research revealed that more than half of the sample use OTC antibiotics for every illness. Sore throat was the illness for which antibiotic was most used. This finding disagrees with the reports of Samreen et al 2017where common cold and Abu et al 2016where fever was the illness for which antibiotics were most used [7,8].

It was found in the present research that a large share of the sample (42.75 %) had obtained their antibiotics from sources other than physician. However, this is less when compared to the reports of AmmarJairoun et alaccording to which 55.1 % of the sample had procured antibiotics OTC[9].This research also revealed that more than half of the total sample (51.5 %) had used OTC antibiotics in the previous year. This is much more than the 23 % and 34 % of OTC antibiotic use reported by Samreen et al 2017 and Abu ObaidaYassinrespectively[7,10]. Out of the 51.5 % who had used OTC antibiotics in the previous year, about half the sample (46.6 %) had used it many times. This is higher when compared to the reports of Samarth V et al 2017 which revealed that 40 % of students used OTC antibiotic many times in the previous year[11]. Nevertheless, the share of sample using OTC antibiotics and the frequency of use among them were less than the findings of Aljayyousi et al, who reported that 60 % of university students had used OTC antibiotics in the previous year and 70 % of them had used it multiple times [12]. It was also found that more than two third of the respondents procured their antibiotics upon demand from the physician and this proportion ismore than double when compared to the 31.2 % reported by Suleiman et al in 2012 [13].Another important finding of the present study was that nearly half of the sample had used antibiotics for an improper duration. This is in agreement with Hani et al 2016 who reported that half of the sample had used antibiotics for 3 days or less [14]. These findings indicate that there is an alarming increase in these unhealthy trends.

The association of various risk factors with the pattern of antibiotic use was also studied. It was revealed from the present research that age group of the sample had significant association with the source of antibiotics ($p<0.01$) anduse of OTC antibiotics ($p<0.01$) in the previous year. About two third of the sample of age 25 and above had procured their antibiotics through a physician and this trend was found to increase with increase in age of the students. Similarly, majority of the sample in the age group had not used OTC antibiotics while more than half of the sample in the lower age groups had used them. This finding points to the fact that younger students are at high risk for using OTC antibiotics.This disagrees with the findings of Aljayyousi GF which states thatage of the students is not a significant risk factor for OTC antibiotic use [12].

Similarly, family income was found to be a significant risk factorfor most aspects of antibiotic use among students. It was significantly associated with source for antibiotics ($p<0.01$), OTC antibiotic use in the previous year ($p<0.01$), frequency of antibiotic use, management of missed dose ($p<0.001$) and duration of antibiotic therapy ($p<0.01$). More than half of the sample in the low income group had obtained their antibiotics from sources other than physician while more than half the sample from the middle and high income group had their antibiotics prescribed by a physician. The percentage of sample using left over antibiotics was found to decrease with increase in family income which shows that income is a risk factor for improper antibiotic use. More than half of the sample in the low and moderate income group had used OTC antibiotics in the previous year while majority of the sample in the high income group had not. One third of the sample in the low income group had abruptly terminated the antibiotic therapy in case of missing a dose and more than three fourth of the sample in the high income group had used antibiotics for an inappropriate duration. All these findings reveal that family income has close association with antibiotic use behaviours among university students and this disagrees with the reports of Aljayyousi GF which states otherwise [12].

Another important finding of the study was that having a health professional in the family had significant association with the frequency of OTC antibiotic use ($p<0.01$) management of missed antibiotic dose ($p<0.05$) and the duration of antibiotic therapy ($p<0.05$). More than half of the sample who had a health professional in the family had used OTC antibiotics many times in the previous year. Similarly, more than one quarter of the sample whose family had a health background had terminated the therapy when they missed a dose and when they felt better. These findings are in agreement with the reports of DandanPeng which stated that students whose parents had a medical background were associated with higher antibiotic misuse behaviours [15].

The present research also revealed that the employment status had significant association with most aspects of antibiotic use. More than half the sample with a part time job had obtained their antibiotics from sources other than physician and this relationship had a significant correlation ($p<0.01$). This finding disagrees with the reports of Abdulrahman Al Rasheed which states that job engagement is not a risk factor for the self prescription of antibiotics [16]. About two third of the sample with a part time job had used OTC antibiotic in the previous year ($p<0.01$) and about one third of this group had terminated the antibiotic therapy when they missed a dose ($p<0.001$) and nearly half the sample in this group had practiced ideal duration of antibiotic therapy ($p<0.01$). All these findings underline that having a part time job is a serious risk factor for the antibiotic use behaviours among students.

Place of residence had significant association with the source of antibiotics and duration of antibiotic therapy.More than half the sample from all three groups (big town, small town and village) had their antibiotics through a physician, showing a similar trend and this disagrees with the reports of DandanPeng which states that students from rural areas were more likely to be prescribed with antibiotics by doctors [15]. More than one quarter of the sample from small town had procured their antibiotics from the left over of their previous course while more than half the sample from the village had used antibiotics for an insufficient period (1-3 days).

The sample in thenon health science courses had better antibiotic use behaviours with respect to compliance with dosage timings and management of missed dose. These relationships have significant correlation ($p<0.05$) and suggest that being enrolled in a health science course does not have a positive influence on the proper use of antibiotics. However, this disagrees with the reports of DandanPeng which states that having a medical background represents a protective factor for antibiotic use behaviours [15]. Besides this, more than half the sample from heath science course had used OTC antibiotics many times in the previous year although, there is no significant correlation. This supports the reports of Ghadeer et al which states that most of the sample from medical courses had a high frequency of OTC antibiotic use [17].

Marital status of the students was found to have no association with any of the antibiotic use behaviours. Similar trends were

observed among all the three groups (single, married, divorced) with respect to various aspects of antibiotic use. Nevertheless, it is noteworthy that only a small share of the married sample (less than one third) had procured their antibiotics from sources other than physician when compared to other two groups, although this relationship is not significant. Hence, this finding agrees the finding of Abdulrahman Al Rasheed that marital status is not a risk factor for the self prescription of antibiotics [16].

The relationship between proper/improper use of antibiotics with various risk factors was also studied, although there were no such reports in the literature. Age of the sample was found to have significant association with proper/improper use of antibiotics and inappropriate use was observed in more than half of the total sample.

CONCLUSION

Inappropriate use of antibiotics was observed among more than half of the sampleand more than two third of the total sample found to have used antibiotic without prescription last year.All socio demographic factors studied except marital status had significant association with one or more aspects of antibiotic use. However, family income was found to be significantly associated with most aspects of antibiotic use. Age was found to be significantly associated with the proper/improper use of antibiotics.

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Conflicts of interests

None

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