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**ASSESSMENT OF KNOWLEDGE AND AWARENESS OF ANTIBIOTICS
RESISTANCE AMONG RESIDENTS OF DEBARK TOWN,
NORTH EAST GONDAR, ETHIOPIA, 2009**

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Abstract

Antimicrobial resistance (AMR) is one of the world's most serious public health problems. The public plays a key role in the emergence and spread of bacterial resistance to antibiotics. But little is known about public understanding of and awareness to antibiotics resistance and whether this could modify treatment and reduce the chance of occurrence of antibiotic resistance. To assess knowledge and awareness of antibiotics resistance among residents of Debarik Town, North East Gondar, Ethiopia. Community based cross sectional survey was conducted. The study was conducted in Debarik town from May 20 to June 20/2009. A total of 403 questionnaires were distributed by trained research assistants. The questionnaires were handed to participants at their home after obtaining the permission. Completed questionnaire were returned. 294 (75.77%) of the respondents have never heard about bacterial resistance towards antibiotics and 94 (24.23) of them heard the term antibiotic resistance, but they didn't know the causes and its implications. Among the total respondents, 382 of them do not know the difference between antibiotic resistance and body immunity. 289 respondents believed that irresponsible health professionals are responsible and blamed, 233 of the respondents believed that irresponsible individuals or patients are responsible and blamed for the occurrence of bacterial resistance towards antibiotics. Only 89 respondents agreed with the risk factors for the bacterial resistance towards antibiotics. 268 (67.78%) respondents believed in the rational use of antibiotics and 15(3.87%) of the respondents agreed to limit their use of antibiotics to reduce the risk factor for the occurrence bacterial resistance. Only 13 thought that science would provide the solution through the development of new drug. Most of the respondents have never heard the term "Antibiotic resistance" and the difference between antibiotic resistance and body immunity. Almost three-fourth of respondents believed that irresponsible health professionals are responsible and to be blamed and other respondents believed that irresponsible individual or patients are responsible for bacterial resistance toward antibiotics. In general, gaps in terms of knowledge, attitude and practice regarding antibiotics use among respondents 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.

Keywords: Antibiotics, Antibiotic resistance, Bacterial infection, Health professional.

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Introduction

Antibiotics are chemical substances produced by a microorganism which has the capacity, in dilute solutions, to inhibit the growth of or to kill other microorganisms. Antibiotics that are sufficiently non-toxic to the host are used as chemo-therapeutic agents in the treatment of infectious diseases of animals and plant without serious toxicity to the host. Some examples of antibiotics include Penicillin, Tetracycline, Amoxicillin, Ampicillin, Chloramphenicol, etc.¹

Irrational use of antibiotics is a key reason for the increase and spread of antibiotic resistance. Several factors may enhance irrational antibiotics usage, which could be doctors' knowledge and experiences, diagnostic uncertainty, patients' expectations, lack of patient and health care professional's education, pharmaceutical marketing, antibiotic selling without a prescription as well as economic and political reasons.² Antimicrobial resistance has been called one of the world's most pressing public health problems. The continuing emergence of pathogenic microorganisms that are resistant to first line antimicrobial is cause of increasing concern. This emergence is also associated with higher level of mortality and morbidity which has impact not only on patients but also increases the burden on health care services as a result of additional diagnostic testing, prolonged hospital stay and increased intensity and duration of treatment.³

The study done in United Kingdom in 2000 showed that there was uncertainty concerning the nature and implications of antibiotic resistance for both individuals and the wider community. 45% of respondents stated that they were not concerned about antibiotic resistance. Many thought that science would provide solution through the development of new drugs.⁴

A survey conducted in Britain in 2003, showed that 79% of respondents were aware that antibiotic resistance is a problem in British hospitals², 38% of respondents did not know that antibiotics do not work against most coughs or colds and 43% did not know that 'antibiotics can kill the bacteria that normally live on the skin and in the gut'. Respondents with lower educational qualifications were less knowledgeable about antibiotics.⁵

A qualitative grounded theory interview study was undertaken from March 2005-March 2006 in Cardiff University UK. The participants were uncertain about bacterial resistance and their explanations were generally incongruent with prevailing biomedical concepts. Perceived importance and personal threat were low. The media was the main information source and it left the impression that dirty hospitals are the main cause. Some participant's dreaded hospitalization because they feared resistant infections. Few recognized resistant infections as a problem in the community. Less than a quarter indicated that they could positively influence the situation by expecting antibiotic prescriptions less often, or taking antibiotics according to instructions and even fewer through their own hand washing behavior.⁶

A postal survey in Northeast Scotland, Grampian, to 605 patients registered with two general practices showed that 326 (93%) had experience of antibiotic use and 319 (81%) were happy to take antibiotics when necessary. 158 (45%) were concerned about antibiotic resistance. Few would expect antibiotics to treat a slight cold or heavy cold, but around half would expect antibiotics for very sore throats and influenza. 262 (75%) indicated they would ask a pharmacist for advice about the treatment of respiratory tract infection. Most respondents experienced at least one episode of respiratory tract infection during the review period. 280 (80%) provided details of their most recent episode; most self-treated, 57 consulted a doctor of whom 43 (75%) were prescribed antibiotics.⁷

A study done in Jordan indicated that 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. Scoring level analysis revealed inadequate knowledge, high consumption rates and self-medication among students regardless of their specialty.²

A study conducted in the state of Penang, Malaysia involving 408 respondents showed that nearly 55% of the respondents had a moderate level of knowledge. Three quarters of the respondents (76.7%) could correctly identify that antibiotics are indicated for the treatment of bacterial infections. However, 67.2% incorrectly thought that antibiotics are also used to treat viral infections. About 59.1% of the respondents were aware of antibiotic resistance phenomena in relation to overuse of antibiotics. With regard to attitudes, 38% believed that taking antibiotics when having cold symptoms could help them to recover faster, while 47.3% expected antibiotics to be prescribed for common cold symptoms. Age, race and educational level were among the demographic characteristics significantly associated with knowledge and attitudes toward antibiotic use. Poor level of knowledge was found in less than one-third of the respondents whereas more than one-third of the respondents wrongly self-medicate themselves with antibiotics once they have a cold.⁸

A study on survey of public knowledge and awareness related to antibiotic use and resistance to 1000 respondents in Sweden showed that of the respondents, 19.1% agreed that antibiotics cure common colds more quickly; this belief was higher in those who had not previously received antibiotics. A high proportion, 80.7%, agreed that bacteria could become resistant to antibiotics. Trust in doctors was high, and significantly more respondents reported trusting the doctor not prescribing an antibiotic, 87.0%, than the doctor prescribing an antibiotic, 81.0%. The respondents showed some confusion surrounding the terms 'bacteria' and 'viruses', and the meaning of these in relation to the prescribing decision.⁹

The aim of this study was to evaluate the current knowledge and awareness of antibiotics resistance among residents of Debarq town, North East Gondar, Ethiopia. Also to identify the gaps in the knowledge and awareness of tackling self-medication and the abuse of antibiotics.

Methods

Study design, period and setting

Community based cross sectional survey was conducted. The study was conducted in Debarq town from May 20 to June 20/2009. The town has 3 kebeles and a population of 32,500. Its weather

condition is "Dega" (cold climate). The town has one hospital, one health center, four private clinics and two private drug stores.

A total of 403 questionnaires were distributed by trained research assistants. The questionnaires were handed to participants at their home after obtaining the permission. Completed questionnaire were returned. A structured questionnaire was developed by reviewing relevant literature and questionnaires used previously in similar studies.^{2, 10, 11} The questionnaire was field-tested several times on a pilot sample of 20 participants (5% of the target sample) to clarify any ambiguities.

The questionnaire comprised a total of 37 questions divided into three sections. The first section covered participants' demographic data such as sex, religion, age, educational level and monthly income. The second section involved the source of antibiotics used by the participants, the frequency of antibiotic use over the past year and reasons leading to antibiotic resistance. The third section assessed participants' knowledge on antibiotic resistance. Permission was sought from the authorities of the town before commencement of the study.

Data analysis

The data were coded, entered, and analyzed using the statistical package for social sciences program (SPSS) version 17. Descriptive results were expressed as frequency, percentage, and mean \pm S.D.

Results

Out of the 403 questionnaires distributed, 388 were returned (response rate = 96.3%). Females constituted 216 (55.67%) and males were 172 (44.32%). Most of the respondents 171 (44.07%) were between 18 to 26 years old. Regarding education level: 49 (12.6%) were illiterates, 69 (17.78%) were at primary school level, 146 (37.62%) were secondary school level, 43 (11.08) completed diploma and 38 (9.79%) completed degree. Most respondents 289 (74.48) were orthodox Christian and 16 (4.12%) were single, 186 (47.93%) were married, 56 (14.43%) were divorced and 33 (8.50%) of this were widowed. Almost one third of the respondents' 126 (32.47%) monthly income ranged 150-300 birr (Table 1).

Table No. 01: Demographic characteristics of the 388 respondents in debark town, North east gondar, Ethiopia.

Variable	Number (N= 388)	Percentage (%)
Sex		
Female	216	54.89
Male	172	44.32
Age		
18-26	171	44.07
27-35	81	20.88
36-40	81	20.88
Above 40	61	15.72
Education status		
Cannot read and write	49	12.69
Primary education	69	17.73
Secondary education	146	37.62
Diploma	43	11.08
Diploma and above	38	9.79
Marital status		
Single	113	29.12
Retried	186	47.93
Divorced	56	14.43
Widowed	33	8.50
Religion		
Orthodox Christian	289	74.48
Muslim	87	22.42
Protestants	26	6.70
Other	16	4.12
Monthly income		
From 150-300	126	32.47
From 300-500	63	16.23
From 500-1000	56	14.43
Greater than 100	63	16.23
Living with family	80	20.61

Table No. 02: Respondents' Awareness toward Bacterial Infection and Its Treatment in Debark Town, North East, Ethiopia.

Questions	Response	Number	Percentage (%)
Have you or your family ever suffered from bacterial infections?	Yes	361	93.04
	No	27	6.96
Did you take antibiotic for that specific bacterial infection?	Yes	348	96.4
	No	13	3.60
In the past few years have you encountered infectious disease repeatedly?	Yes	162	44.9
	No	182	53.45
Did you use antibiotic for every illness you encountered?	Yes	65(162)	40.12
	No	97(162)	59.88
Did the antibiotic you used repeatedly cure you?	Yes	35(65)	53.85
	NO	30(65)	46.15

Awareness of bacterial infection and its treatment

The majority of respondents 361 (93.04%) were suffered from different bacterial infections and 27 (6.96%) were not suffered from bacterial infection. 348 (96.4%) of respondents who suffered from bacterial infection took antibiotics to treat that

specific bacterial infection and 13 participant didn't take due to unknown reason. Among respondents who suffered from bacterial infection 162 (44.9%) were repeatedly suffered at various times. From 162 respondents, 65 (40.1%) procured the antibiotic for that specific infection from the same place and 97 (59.9%) did not take antibiotics

repeatedly. Among 65 respondents who took antibiotics repeatedly 35 (53.9%) of them got cured and 30 (46.2%) of them were not cured (Table 2).

The knowledge, attitude and behavior of respondent (who obtain antibiotic with prescription) regarding antibiotic use

Among 388 respondents 82(34.15%) of them obtained antibiotics from health facility pharmacy with prescription. While prescribing and dispensing of drugs for patients, clear verbal and/or written

information was not considered. Even if information was given to the patient by the health professional, 29 (35.37%) of respondents did not apply the verbal and/or written information they get from the health professional; 39 (47.56%) stop the treatment for the following reasons: 23 (53.49%) stop treatment due to they felt better, 29 (67.44%) stop treatment due to their assumption that the antibiotic is ineffective, 21 (48.84%) stop treatment because the forgot the dose and 28 (65.11%) stopped treatment due to negligence (Table 3).

Table No. 03: The knowledge, attitude and behavior of respondent (who obtain antibiotic with prescription) regarding antibiotic use

Statements evaluating knowledge, attitude and behavior	Number	Total	Percentage (%)
Respondents who were informed about antibiotic resistance verbally and/or with any written material by the health professional	28	82	34.15
Respondents who were informed about the consequence of stopping treatment verbally and/or with any written material without consulting their clinician	29	82	35.37
Respondents who followed clinician instruction when prescribed antibiotics	38	82	46.34
Respondents who did not complete their last course of antibiotics	39	82	47.56
Reasons stated by respondents not completing their last course of antibiotics			
Felt better	23	43	53.49
Antibiotics proved ineffective	29	43	67.44
Forgot the dose	21	43	48.84
could not be bothered	28	43	65.11

Table No. 04: The knowledge, attitude and behavior of respondent (who obtain antibiotic without prescription) regarding antibiotic use

Statements evaluating knowledge, attitude and behavior	Number	Total	Percentage (%)
Respondents who were informed about "How often" and "How much" to take the antibiotic verbally and/or with any written materials	63	97	64.94
Respondents who were informed about the consequence of stopping treatment before finishing the antibiotic verbally and/ or with any written material	4	97	4.12
Reasons given by respondents who obtain antibiotics without prescription			
Respondents who obtain antibiotic without prescription based on their past experience	34	61	55.74
Respondents who obtain antibiotic without prescription based on the advice given buy their friends, neighbors etc	27	61	44.26
Respondents who obtain left-over antibiotics from friends, neighbors etc	19	36	52.78
Respondents who obtain left-over antibiotics from family members	23	36	63.89

The knowledge, attitude and behavior of respondent (who obtain antibiotic without prescription) regarding antibiotic use

97 respondents obtained the antibiotic without prescription from drug retailers and/or use left-over drugs. 61 respondents obtained the antibiotic from drug store without prescription. The reason why they procure the antibiotic without prescription: 34 (55.74%) of them based on their past experience, 27 (44.26%) of them due to pressure from their friends and/or neighbors. The remaining 36

respondents share and/or use left-over antibiotics. 63 (64.94%) of the 97 respondents who obtained antibiotics without prescription were informed about "How often" and "How much" to take the antibiotic verbally and/or with any written materials. 4 of the respondents were not informed about the consequence of stopping treatment before finishing the antibiotic verbally and/ or with any written material (Table 4).

The knowledge, attitude and behavior of respondent regarding antibiotic resistance

About 294 (75.77%) of respondents have never heard of the term “antibiotic resistance”. The remaining 94 (24.23%) respondents have heard the term antibiotic resistance from health workers (64), mass media (17) and friends (13). About 382 (98.45%) participants couldn't define/ explain what antibiotic resistance is. Only 6 (1.55%) of respondents described antibiotic resistance. 382 respondents do not know the difference between

antibiotic resistance and body immunity i.e. 263 (67.78%) respondents responded that antibiotic resistance refers to the body immunity against antibiotics and 119 (30.67%) participants responded that it refers to bacteria becoming resistant to antibiotics. More than fifty five percent of the respondents believed that the emergence of antibiotic resistance is due to bacteria becoming resistant to antibiotics through antibiotic overuse or long term use (Table 5).

Table No. 05: The knowledge, attitude and behavior of respondent regarding antibiotic resistance

Variable	Responses	Number	Percentage (%)
Whether respondents heard of the term “antibiotic resistance” before	Yes	94	24.23
	No	294	75.77
Whether respondents know antibiotic resistance	Yes	6	1.55
	No	382	98.45
Sources of information that respondents had heard about antibiotic resistance	Healthy worker	64	16.49
	Mass media	17	4.38
	Friends	13	2.37
Whether respondents know the difference between antibiotic resistance and body immunity	Yes	6	1.55
	No	382	98.45
Respondents' opinion about whether antibiotic resistance is due to body immunity against antibiotics or due to the bacteria becoming resistant to antibiotics	due to body immunity	263	67.78
	due to bacteria becoming resistant	119	30.67
Whether over use or long term use of antibiotic is related with the risk of developing antibiotic resistance	due to body immunity	174	44.85
	due to bacteria becoming resistant	214	55.15

Respondents' attitude towards the cause of bacterial resistance

Respondents have different attitude regarding the risk factor for the development of bacterial resistance toward antibiotic. Almost equal number of the respondents believed that the specific cause of bacterial resistance is over use (56) and under use (53). Other causes of bacterial resistance mentioned by respondents were failure to complete

the course of therapy 47 (12.11%), sharing antibiotics with other person 58 (14.95%), incorrect diagnosis 60 (15.46%), obtaining antibiotic without prescription 38 (9.79%), unnecessary prescription 65 (16.75%), failure to apply the advice given by the health professionals 68 (17.56%) and others 49 (12.63%). Those respondents who didn't know the cause of bacterial resistance were 39 (10.05%) (Table 6).

Table No. 06: Number of participants who mentioned specific causes of bacterial resistance

Specific causes	Number	Percentage (%)
Over use	56	14.43
Under use	53	13.66
Failure to complete the course of therapy	47	12.11
Sharing antibiotics with other person	58	14.95
Incorrect diagnosis	60	15.46
Obtaining antibiotic without prescription	38	9.79
Unnecessary prescription	65	16.75
Failure to apply the advice given by the health professionals	68	17.53
Others	49	12.63
I don't know	39	10.05

Consequences of bacterial resistance and resistant infections

Respondents have different opinion about problems associated with antibiotic resistance. Out of total respondents 388, only 89 (22.94%) believed that the antibiotic resistance has a problem. From 89 respondents, the majority 86(96.62%) believed that there will be a need for expensive drugs and those

who didn't know the consequence were 69 (75.53%). Increased intensity and duration of treatment, higher levels of mortality and morbidity, additional diagnostic testing, prolonged hospital stay, increased intensity and duration of treatment and increased work burden on health care service provider were also cited as consequences of bacterial resistance and resistant infection (Table 7).

Table No. 07: Consequences of bacterial resistance and resistant infection

Response	Number(89)	Percentage (%)
Decreasing the activity of the drug	56	62.92
Higher levels of mortality and morbidity	13	14.61
Additional diagnostic testing	31	34.83
Need for other expensive drugs	86	96.62
Prolonged hospital stay	35	39.33
Increased intensity and duration of treatment	38	42.70
Increases the burden on health care service provider	36	40.45
If you know other specify	39	43.82
I don't know	69	75.53

Discussion

Generally, there is unawareness among respondents concerning the nature and implications of antibiotic resistance. In this study, unawareness of antibiotic resistance is more 294 (75.77%) when compared to the Scottish survey in 2000 which is 45%¹² and to the Taiwan survey 0% (all the respondents were aware).¹³ Only 89 (22.29%) respondents agreed with the idea that bacterial resistance has certain problem. While some respondent view has a problem for the wider society, most did not see it has something that would affect them personally and therefore did not perceive a reason to modify their own individual antibiotic use. However, in a recent great British Household survey, only 19% of respondent were not concerned about antibiotic resistance, suggesting an increased awareness through media publicity and public information campaigns.¹⁴

A survey in North Dakota State University indicated that 61% of men respondents and 84% of female respondents obtain antibiotics from pharmacies with prescription while in our study it was 34.15%. In this study the percentage of respondents (52.42%) who used the drug to full extent of the prescription was comparable to the North Dakota State University's survey (57% of men and 63% of women).¹⁵ 53.49% of the students stopped taking their antibiotics when they felt better or when the symptoms of their infections appeared to have stopped which is similar to the

study done among a group of Nigerian university students.¹⁶ Most respondents 269 (69.23%) agreed that bacterial resistance towards antibiotics is due to the development of body immunity against antibiotics. These respondents idea was that long-term use of antibiotics can help in developing body immunity and served to reinforce antibiotic resistance. Some of the respondents were agreed that antibiotic resistance is due to overuse, under use, failure to complete the course of therapy and sharing antibiotics with other person. From the total respondents (388), only 94 respondents were aware of bacterial resistance toward antibiotics, and only 6 respondents define the term antibiotic resistance and 382 respondents don't know the difference between antibiotic resistance and body immunity. However, Great Britain face-to face survey in the year 2003, 77% of respondents were aware that antibiotic resistance is a problem in Britain hospital, 38% of respondents did not know that antibiotic do not work against most cough or cold.¹³ In the present study, more than 55% percent of the respondents believed that the emergence of antibiotic resistance is due to bacteria becoming resistant to antibiotics through antibiotic overuse or long-term use. 52.78% of the respondents use left-over antibiotics which was comparable to the study done in Jordan (49.0%).¹⁷ 10.05% of the respondents did not know the specific cause of antibiotic resistance that indicated that respondents had better knowledge about the cause of resistance

as compared to the study done in South Korea (75%).¹⁸

Conclusions

Most of the respondents have never heard the term "Antibiotic resistance" and the difference between antibiotic resistance and body immunity. Almost three-fourth of respondents believed that irresponsible health professionals are responsible and to be blamed and other respondents believed that irresponsible individual or patients are responsible for bacterial resistance toward antibiotics. The majority of respondents agreed with the ideas of risk factor for the bacterial resistance toward antibiotic they believed that the rational use of antibiotic and completing the entire course of antibiotics therapy could reduce the occurrence of bacterial resistance toward antibiotic. In general, gaps in terms of knowledge, attitude and practice regarding antibiotics use among respondents 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.

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References

1. David, Thomas L., Lemke: Foye principle of medical chemistry. Lippincot Williams and Wilking, 5th edition 2002, P. 819-825
2. Suaifan G. A. R. Y., Shehadeh M., Darwish D. A., Al-Ijel H., Yousef A. M. and Darwish R. M: A cross-sectional study on knowledge, attitude and behavior related to antibiotic use and resistance among medical and non-medical university students in Jordan. Afr. J. Pharm. Pharmacol.2012; 6(10): 763-770
3. World Health Organization (1997) WHO/IUATLD Global working group on antituberculosis drug resistance in Tuberculosis, PP 96
4. Brooks L, Shaw A, Sharp D, Hay AD: Towards a better understanding of patients' perspectives of antibiotic resistance and MRSA: a qualitative study. Fam Pract. 2008; 25(5):341-8
5. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P: Don't wear me out--the public's knowledge of and attitudes to antibiotic use. J Antimicrob Chemother. 2007; 59(4):727-38
6. Hawkings N. J., Wood F. and Butler C. C: Public attitudes towards bacterial resistance: a qualitative study. Journal of Antimicrobial Chemotherapy 2007; 59, 1155-1160
7. Emslie MJ, Bond CM: Public knowledge, attitudes and behaviour regarding antibiotics--a survey of patients in general practice. Eur J Gen Pract. 2003; 9(3):84-90.
8. Oh A. L., Hassali M. A., Al-Haddad M. S., Sulaiman A. S., Shafie A. A., Awaisu A: Public knowledge and attitudes towards antibiotic usage: a cross-sectional study among the general public in the state of Penang, Malaysia. J Infect Dev Ctries 2011; 5(5):338-347.
9. André M, Vernby A, Berg J, Lundborg CS: A survey of public knowledge and awareness related to antibiotic use and resistance in Sweden. Journal of Antimicrobial Chemotherapy 2010; 65(6):1292-1296.
10. Chen C., Chen Y., Hwang K., Lin S., Yang C., Tsay R. , Liu C., Young T: Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan. J Microbiol Immunol Infect 2005; 38:53-59
11. Buke C, Hosgor-Limoncu M, Ermertcan S, Ciceklioglu M, Tuncel M, Köse T, Eren S. Irrational use of antibiotics among university students. J. Infect. (2005); 51: 135-139.
12. Emslie, M.J., Band, C.M., Public Knowledge, attitudes and behavior regarding antibiotics: a survey of patients in general practice (2000). EUR J. Gen pract
13. Chen C., Chen Y., Hwang K., Lin S., Yang C., Tsay R., Liu C., Young T. Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan. J Microbiol Immunol Infect 2005; 38:53-59.

14. Eng J. V., Marcus R., Hadler J. L., Imhoff B., Vugia D. J., Cieslak P. R., Zell E., Deneen V., McCombs K. G., Zansky S. M., Hawkins M. A. and Besser R. E. Consumer attitude and use of antibiotics. *Emerg Infect Dis.* 2003;9:1128-1135
15. Nelson J. and Burslie T. An Assessment of Public Understanding of Antibiotic Resistance and Misuse. *The Growing Dangers of Antibiotic Resistance.* North Dakota State University 2010.
16. Abimbola I. O. Knowledge and practices in the use of antibiotics among a group of Nigerian university students. *Int J Infect Control* 2013, 9:1
17. Shehadeh M., Suaifan G., Darwish R. M., 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 Pharmaceutical Journal* 2011, doi:10.1016/j.jsps.2011.11.005
18. Sun K. S., Seongmi M., Jung K. E. Public Knowledge and Attitudes Regarding Antibiotic Use in South Korea. *J Korean Acad Nurs* 2011; 4(16): 742-749.