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KNOWLEDGE, ATTITUDES AND PRACTICES REGARDING THE USE OF ANTIBIOTICS: A CROSS-SECTIONAL STUDY FROM A RURAL AREA OF LEBANON

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Abstract

Despite the presence of a national policy restricting the easy access to antibiotics, irrational use of antibiotics continues to be widespread both in human use and livestock production in Lebanon. This study targets the general population in the rural region of Bekaa to assess their knowledge, attitudes and practices (KAP) towards antibiotic use. A cross sectional questionnaire was completed by 1151 participants, through face-to-face interviews. Study population was randomly selected. Descriptive statistics and correlation tests were applied in data analysis. 69.2% of participants had a very poor knowledge about antibiotics. More than 70% believed that viral infections may be treated by antibiotics; interrupting therapy when conditions improve and sharing antibiotics were considered appropriate by 79.4% and 80.3%, respectively. Only 14.1% were aware of the concept of "antibiotic resistance" and 58.3% didn't know that antibiotics were used in animals. Despite their poor knowledge, more than half of participants (55.2%) expressed good attitude in terms of need for prescriptions (79.1%) when needed only (89.5%) and on the minimal use in agriculture (74%). Such positive attitude was generally reflected by their overall moderate practice among participants (65.8%). Nevertheless, only 10.9% of the participants obtained their antibiotics through a prescription, 62.7% kept leftover antibiotic for future use and 83.2% interrupted their antibiotic treatment. Moreover, participants' attitudes and practices were significantly associated with gender, age and educational level. However, knowledge was associated only with gender and education. Knowledge showed significant positive correlation with attitude and practice. Findings suggest that intervention awareness programs specifically targeting specific segments in rural regions can be effective in directing the public to the rational use of antibiotics. Further research is recommended by conducting nationwide KAP studies covering communities of both urban and rural regions.

Keywords

Antibiotic; Antibiotic resistance; Antibiotic use; General public; KAP; Rural region; Lebanon

1. INTRODUCTION

Antibiotics have, since their discovery, played a substantial role in the control and management of infectious diseases (Adedeji, 2016). The significance of the positive effects of the antibiotics' use is reflected in the definition given by World Health Organization as "medicines used to prevent and treat bacterial infections" (WHO, 2020). However, the irrational use of antibiotics poses serious risks on human health making the antibiotic resistance a serious global challenge nowadays (Caudell et al., 2020). Such irrational use has been associated with the emergence of antibiotic resistant bacteria (ARB) and resistance genes (ARGs), thus jeopardizing human and animal infectious disease control (Almakki et al., 2019). Infections with resistant bacteria result in delayed duration of therapy, increased mortality and increased cost of treatment (Bonine et al., 2019). Complex factors underlie the process of antibiotic resistance emergence. Such as the improper use of antibiotics, lack of proper regulatory policies , poor infection control and prevention procedures (Awad & Aboud, 2015; El Khoury et al., 2018; Zahreddine et al., 2018). To reduce the improper and excessive use of antibiotics, the general public must be educated and informed about the rational of the antibiotic uses and the emergence of resistance (Meena et al., 2019). Thus, it is important to apprehend their knowledge, attitudes and practices (KAP) necessary to rationalize antibiotic use. (Voidăzan et al., 2019). A number of studies related to antibiotic use have investigated KAP among selected groups and general public in different countries indicating significant variation depending on educational level, gender, socio economic status and other demographic features (Awad & Aboud, 2015; Higuita Gutiérrez et al., 2020; Bassoum et al., 2018). Lebanon, like other countries, faces quite high levels of resistance to antibiotics (Salameh et al., 2017). Despite the policies laid by the Lebanese government that restrict the purchase of antibiotics without prescriptions (Gelband & Delahoy, 2014), over the counter (OTC) dispensing and other inappropriate ways to obtain and use antibiotics in human and livestock are still widespread (Jammoul & Darra, 2019) and in Middle East, prescription medicines can easily be purchased without prescription, resulting in potential misuse and unnecessary risk (Khalifeh et al., 2017). Such malpractices are expected to continue with the escalating need for more control over infectious disease along with the growing demands of livestock production caused by the surge in population size during the last decade. In this context, a study conducted in the capital city of Beirut and its suburbs has shown that community pharmacists prescribe about 40% of antibiotic therapy (Cheaito et al., 2014). Another research evaluated the antibiotic prescribing rate for acute bacterial rhinosinusitis in community pharmacies concluding that antibiotics were frequently prescribed by Lebanese community pharmacies (Yaacoub et al., 2019). Furthermore, a cross-sectional analysis on university students found misleading theories and improper practices toward antibiotic use among students with non-health related majors (Sakr et al., 2020). One study was conducted on general public (Mouhieddine et al., 2015) and another targeting parents of school children (Mallah et al., 2020). With the exception to the latter 2 studies, the above mentioned research was restricted to specific groups and sectors in the capital city of Beirut and its suburbs (i.e., pharmacies, hospitals, university students…etc.) with emphasis on antibiotic use for human health. Moreover, all these studies with no exception were conducted in the capital city of Beirut and its suburbs making the assessment of KAP of the antibiotic use among general public in rural regions necessary. This study was designed with the aim to respond to this need expecting that findings will contribute to the development and implementation of evidence-based interventions needed to control the emergence and spread of antibiotic resistance in the country.

2. MATERIALS AND METHODS

2.1 Study Design

This study is a cross-sectional descriptive study.

2.2 Study Area

The study was carried out in the Bekaa Valley, located in East Lebanon, about 30 km east the capital Beirut. This valley is characterized by being mostly a home for agriculture ((LRBMS, 2012) where more than 40% of its lands are cultivated. It harbors the highest number of livestock heads owned by agricultural holdings. Data collection stretched across 3 of its districts, Baalbek, Zahleh and West Bekaa, where most of the population and economic

activities are concentrated (IDAL - Lebanon at a Glance - Invest in Regions - Baalbeck El-Hermel Governorate).

2.3 Study Population

The sampling was conducted using stratified random technique, where the strata are the districts of study area and the subsamples (interviewees) of these strata are randomly selected to make sure they correspond to subpopulations and age structures of the strata.

The study's sample size was determined using the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html), with a margin of error of $\alpha = 5\%$ and a confidence interval of 95%. A sample size of 1,151 was obtained and successful interviews was achieved. Participants were 18 years and above of age, permanent residents in the study area including local Lebanese and non-Lebanese residents.

2.4 Data Collection

The KAP questionnaire designed by the WHO "Antibiotic Resistance: Multi-country Public Awareness Survey " (WHO, 2015) was adapted in this study with some modifications fitting the studied population. The survey was conducted through face-to-face interviews.

The study was conducted in June 2020 to October 2020, just after the termination of the COVID 19 lockdown period (from March 2020 to June 2020). Safety and precaution measures as recommended by the ministry of health and of Interior and Municipalities were strictly followed: social distancing were maintained, facial masks were used, and hand washing and sterilization were done as frequently as possible.

The time needed to complete the questionnaire was 20 min. It consisted of 4 components and contained close-ended questions and one open ended question. A 5-point Likert scale ranging from "strongly disagree" to "strongly agree" (agreement level) was included. The components were: 1) socio-demographic characteristic of the interviewees; 2) knowledge about antibiotics; 3) attitudes (feelings and preconceived ideas) towards antibiotic use and consumption; and 4) practices towards antibiotics use and consumption.

The questionnaire was prepared in English, then translated into Arabic. Participants were offered the choice to answer in either language. In order to get a preliminary validation of the questionnaire, a pretest was conducted on a group of experts (n=13) consisting of pharmacists, dentists, doctors and veterinarians. The clarity, suitability of wording, and the average time needed for completion were assessed. Modifications were then made based on experts' views and comments. Results of the pretest were not included in data analysis.

2.5 Statistical Analysis

The statistical software, IBM SPSS for Windows version 21.0 and Excel were used to perform all statistical analysis. Descriptive statistics for participants' demographics and KAP were reported, expressed as raw numbers and percentages, and the 95% confidence intervals (95% CI) were calculated for all the estimations. Responses to the KAP questions were given a score of "1" for a correct response and "0" for an incorrect or uncertain response, and scores summed for participants across each of the domains. The association between qualitative variables was assessed using the Spearman rank correlation test and Kruskal Wallis test. All test results were interpreted for statistical significance using a threshold of $p = 0.05$.

3. RESULTS

3.1 Sociodemographic Characteristics of Participants

Table 1 showed the sociodemographic features of the study population, the data revealed that the percentage of female participants was higher than the male participants (59.2% vs 40.8%). The majority of participants were between 18 and 34 years of age (56.4%), while 37.3% were between 35-64 years and 6.3% were >64 years of age. Concerning their educational levels, over half of participants (66.4%) had a higher education, 18.4% had a secondary education and 6.1% had a primary education while 9.1% of participants were illiterate with no schooling.

Table 1: Sociodemographic features of the study population

Demographic characteristics	Number	Percentage (%)
Gender		
Male	470	40.8
Female	681	59.2
Age		
Young adult (18-34)	649	56.4
Middle classes (35-64)	429	37.3
Seniors' people (65+)	73	6.3
Education		
No schooling	105	9.1
Primary education	70	6.1
Secondary education	212	18.4
Higher education	764	66.4

3.2 Knowledge about Antibiotics

As illustrated in Table 2, 71.6% of the participants thought that sore throat, cold/flu, fever, diarrhea and HIV/AIDS are treated with antibiotics, while only 27.2% of the participants knew that urinary tract infection should be treated with antibiotics. In addition, only 14.1% of participants indicated that they had heard of "*antibiotic resistance bacteria*". Furthermore, the majority of participants (79.4%) thought they should stop taking antibiotics when they feel better, while only 13.3% believed that the antibiotic course should be completed as directed. The remaining 7.3% had no knowledge regarding the time needed to stop the treatment (Table 2). On the other hand, 80.3% of the participants agreed with the idea of using the same antibiotics that were previously used by some relatives and friends to treat the same disease, while 18.2% opposed this idea. As for the question relevant to purchasing the same antibiotics for conditions previously treated with antibiotics, 35.8% of participants reported the assertion as safe, while 56.3% reported it as false (Table 2).

Table 2: Knowledge about antibiotics

Knowledge about antibiotics	%
Which of these following conditions can be treated with antibiotics?	
HIV/AIDS	2.0
Gonorrhea	1.2
Bladder infection or urinary tract infection (UTI)	27.2
Diarrhea	5.6
Cold and flu	21.7
Fever	3.2
Skin or wound infection	0.0
Sore throat	39.1
Body aches	0.0
Headaches	0.0
When do you think you should stop taking antibiotics once you've begun treatment?	
When you feel better	79.4
When you've taken all of the antibiotics as directed	13.3
Don't know	7.3
Do you think this statement is 'true' or 'false'? *"It's okay to use antibiotics that are given to a friend or family member, as long as they were used to treat the same illness"*	
True	80.3
False	18.2
Don't know	1.5
Do you think this statement is 'true' or 'false'? *"It's okay to buy the same antibiotics, or request these from a doctor, if you're sick and they help you get better when you had the same symptoms before"*	
True	35.8
False	56.3
Don't know	7.9
Have you heard the term antibiotic resistant bacteria?	
Yes	14.1
No	84.1
Don't know	1.8
Do you think antibiotics are used in agriculture?	

	Yes	11.9
	No	29.8
	Don't know	58.3
	Antibiotics are used in agriculture (including in food producing animals) in order to:	
	help them to grow bigger, faster, fatter, boost egg production / size	75.0
	Treatment of infections	18.1
	Prevention of infections	1.4
	Don't know	5.5

Concerning the use of antibiotics in agriculture, over half of participants (58.3%) were unaware that antibiotics are used in agriculture. When participants were informed that antibiotics are used in agriculture, 75.0% thought that they are used to help increasing the growth rate and size of ruminants or boosting egg production and size in poultry (Table 2).

Thus, based on the participants' answers, three groups of knowledge level can be categorized: poor (69.2%), moderate (21.7%) and sufficient (9.1%) (Table 3).

Table 3: Level of knowledge

Level of knowledge	Frequency	Percentage
Poor	797	69.2
Moderate	250	21.7
Good	104	9.1

3.3 Attitude Regarding Antibiotic Use

Results concerning the attitude of the participants regarding the antibiotic use are summarized in Figure 1. Strikingly, 79.1% of the participants strongly agreed on the necessity of using antibiotics only when they were prescribed by a doctor. And, 89.5% strongly agreed the doctors should prescribe antibiotics only when it is needed (not as routine treatment). Also, 69.1% of participants strongly agreed on the necessity to get consultation from a veterinarian before giving antibiotics to the animals. Moreover, 74.0% of participants split between strongly agree (59.8%) and slightly agree (14.2%), thought that farmers should give minimal dose of antibiotics to food producing animals and 62.6% agreed that a withdrawal period should be allowed before products such as meat/egg/milk are consumed after administering antibiotics to livestock. On using antibiotics in livestock production to help the animals to grow bigger, faster, boost egg production/size, 29.0% of participants embraced the idea.

Unfortunately, 70.0% of participants, between strongly disagree (9.6%) and slightly disagree (60.5%), reject the idea that people should not keep antibiotics for future use.

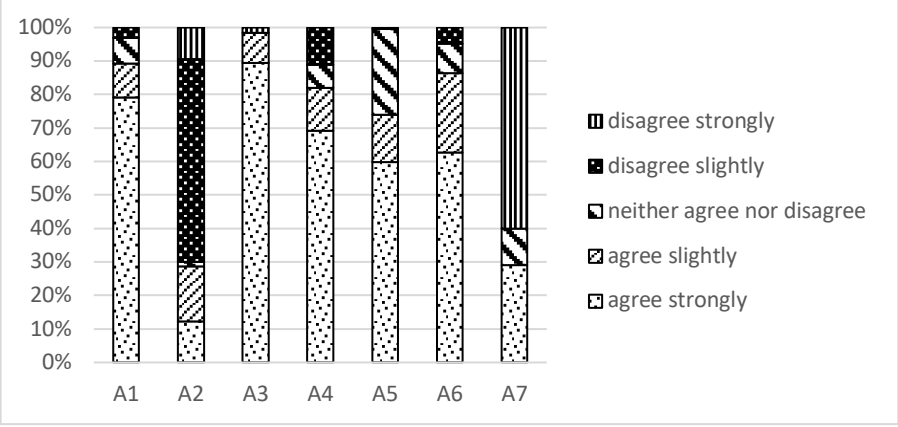

Fig.1: Agreement level with a list of seven actions would help address the problem of antibiotic resistance.

A1 People should use antibiotics only when they are prescribed by a doctor or nurse

A2 People should not keep antibiotics and use them later for other illnesses

A3 Doctors should only prescribe antibiotics when they are needed

A4 It is important to get consultation from a veterinarian before giving antibiotics to the animals

A5 Farmers should give fewer antibiotics to food-producing animals

A6 After using antibiotics on an animal, you should wait sometime before using the products from it, such as meat / egg / milk?

A7 If working in livestock: accept giving animals that are not sick antibiotics to help them grow bigger, faster and boost egg production\size

Again based on the participants responses, we can divide their attitudes into three categories as good (55.2%), moderate (35.3%) and poor (9.5%) as shown in Table 4.

Table 4: level of attitude

Level of attitude	Frequency	Percentage
Poor	110	9.5
Moderate	407	35.3
Good	634	55.2

3.4 Practice Regarding the Use of Antibiotics

When the disease symptoms improved, 83.2% of the participants stopped taking the prescribed antibiotics, and get rid of the rest, 62.7% stopped and kept the leftovers for personal use or distributed them to someone else, while 25.0% continue till it finishes. About 21.5% of participants took the antibiotics a month ago and 20.8% during the previous six months. Only 10.9% of participants reported they got their antibiotics from a doctor while 82.1% were self-prescribed. As for the source of antibiotics, 87.6% reported that they obtained the antibiotics from a pharmacy. Amoxicillin was reported to be the most commonly used antibiotics by participants (Table 5).

Furthermore, the majority of the participants (92.3%) complied with their doctors' advice after consultation and assessment that antibiotic treatment is not needed. They complied with their doctor's requests to wait for the diagnostic test results before deciding whether antibiotic prescription is needed or not (Table 5).

Table 5: Practices regarding the use of antibiotics

Practice regarding the use of antibiotics	%
Do you stop antibiotics when conditions improve?	
Yes	83.2
No	12.8
Don't know	4.0
Do you keep the leftover antibiotics for personal future use or to give to someone else?	
Yes	62.7
No	25.0
Don't know	12.3
When did you last take antibiotics?	
In the last month	21.5
In the last 6 months	20.8
In the last year	8.3
More than a year ago	11.4
Never	4.0
Can't remember	34.0
On that occasion, did you get the antibiotics (or a prescription for them) from a doctor?	
Yes	10.9
No	82.1
Can't remember	7.0
When you consult a doctor and his/her initial assessment result for you indicated that antibiotic is not needed at the moment, would you accept if the doctor tells you to observe for	

few more days or to wait for the diagnostic test's result before deciding whether to prescribe antibiotics or not?	
Yes	92.3
No	0.5
Don't know	7.2
On that occasion, where did you get the antibiotics?	
Medical store or pharmacy	87.6
Agricultural establishment	3.6
The internet	0.0
Friend or family member	2.0
I had them saved up from a previous time	6.3
Somewhere or someone else	0.0
Can't remember	0.5
Antibiotic(s) cited by participants:	Amoxicillin, Erythromycin, Ciprofloxacin, Azithromycin, Levofloxacin, Oxytetracycline, Gentamicin, Cephalosporin, Clarithromycin, Clindamycin, and Aminoglycosides

Overall, based on the participants responses, we can divide their levels of practice into three categories as moderate (65.8%), sufficient (25.7%) and poor (8.5%) as summarized in Table 6.

Table 6: Level of practice

Level of practice	Frequency	Percentage
Poor	98	8.5
Moderate	760	65.8
Good	293	25.7

3.5 Association of participants' knowledge, attitude and practice with demographics

The association between participants' KAP and demographics was assessed using Kruskal Wallis and Sperman rank correlation analysis (Table 7 and 8). Outputs show that the level of good knowledge was associated with being male who received higher education level. Poor knowledge was significantly associated with being less educated female. Significant association was also shown between good attitude and being female, young age group and higher education level. The moderate practice was significantly associated with being female, young and educated.

Table 7: Association between level of knowledge, attitude, practice and demographic variables

	Level of knowledge				Level of attitude				Level of practice			
	Poor	Moderate	Good	P-value	Poor	Moderate	Good	P-value	Poor	Moderate	Good	P-value
Gender												
Male	65.7	20.4	13.8	0.000*	13.6	35.7	50.6	0.000*	9.8	61.1	29.1	0.020*
Female	71.7	22.6	5.7		6.8	34.9	58.3		7.6	69.0	23.3	
Age												
Young	70.9	24.7	4.5	0.309	6.0	26.7	67.3	0.000**	0.2	75.3	24.5	0.000**
Middle	61.8	20.7	17.5		11.0	42.9	46.2		13.5	54.5	31.9	
Seniors'	98.6	1.4	0.0		32.9	67.1	0.0		53.4	46.6	0.0	
Education												
Uneducated	99.0	1.0	0.0	0.000**	17.1	82.9	0.0	0.000**	31.4	68.6	0.0	0.000**
Primary	98.6	1.4	0.0		75.7	24.3	0.0		91.4	8.6	0.0	
Secondary	92.5	7.5	0.0		0.0	35.4	64.6		0.5	85.4	14.2	
Higher	56.0	30.4	13.6		5.1	29.7	65.2		0.0	65.2	34.8	

* Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level (2 tailed)

Spearman rank correlation revealed weak positive linear correlations between knowledge-attitude ($r = 0.247$, $p < 0.01$), attitude-practice ($r = 0.230$, $p < 0.01$) and moderate positive correlations between knowledge-practice ($r = 0.504$, $p < 0.01$) as shown in Table 8.

Table 8: Correlation between knowledge, attitude and practice level

Variable	Coefficient Correlation	P-value**
Knowledge-Attitude	0.247	<0.01
Knowledge-Practice	0.504	<0.01
Attitude-Practice	0.230	<0.01

** means significance test $p < 0.01$. 0–0.09, no correlation; 0.1–0.3, weak correlation; 0.3–0.5, medium correlation; 0.5–1.0, strong correlation.

4. DISCUSSION

This KAP study falls in the context of national and global efforts to combat the emerging challenge of antibiotic resistance given the consensus that general public plays a key role. It is the first KAP study on antibiotics use that targets general public of Bekaa region, a rural zone of Lebanon. It responds to the recent WHO call (WHO, 2018) emphasizing the need to understand key features of different societal groups and geographical regions related to antibiotics use in order to understand pathways and key drivers of effective control. This is specifically important when realizing that all relevant previous studies from Lebanon targeted populations within the district of Beirut paying no attention to populations of other regions.

With respect to knowledge, findings show high prevalence of poor knowledge reflecting inadequate understanding and awareness of appropriate antibiotic use along with major gaps and misconceptions (Table 7). Such poor knowledge may lead to antibiotic resistance and increase the community's sensitivity to antibiotic problems. Specifically, 35.8% of participants' demonstrated misconception regarding self-medication and 80.3% of participants had no problem with sharing medication with other friends and family members. Despite the difference in design and methodology, these values are, in general terms, much higher than those reported in a study on a sample of 500 participants of general public in Beirut city where only 22.4% reported consuming antibiotics on their own accord (Mouhieddine et al., 2015). Whereas, the values were in line with the findings of other studies of the regions (Hawkings et al., 2008; Al mohammed et al., 2019; Shaikhan et al., 2018). The misconception in the herein study regarding diseases treated with antibiotics seems to be widespread in Lebanon and other countries in the region (Awad & Aboud, 2015; Zahreddine et al., 2018). Much higher levels are reported from other countries in Asia and Africa (Bassoum et al., 2018; Nepal et al., 2019). These high values have been explained by the widespread use of the common term "germ" and its equivalents to refer to the causative pathogenic agents of cold and flu, thus, resulting in a lack of differentiation between bacterial and viral diseases (Ling Oh et al., 2011).

Similarly, other misconceptions were indicated in the present study as the majority of participants (79.4%) considered termination of antibiotic course as appropriate when feeling better, unaware of the bad consequences. Numerous studies confirm that patients' failure to complete their drug regimens may enable pathogenic bacteria to develop resistance (Laxminarayan et al., 2006). Current WHO recommendation continues to consider that full courses of antibiotics should be completed to prevent the onset of resistance (WHO, 2015). As the minimum effective treatment durations for many infections have not yet been determined, the emphasis on completing antibiotic courses to prevent resistance may have to be investigated (Pouwels et al., 2019).

As for the influence of gender, the knowledge score was lower for female as compared to males. This may be associated with the higher educational level of male participants and the significant positive association between higher education and good knowledge among participants (Table 7). The positive influence of education on knowledge is found in numerous studies (Barah & Goncalves, 2010; Ling Oh et al., 2011; Nepal et al., 2019; Tshokey et al., 2017) possibly due to the fact that higher educated individuals are able to readily understand health messages, in addition to their higher exposure and accessibility to credible sources of information (WHO, 2009).

On the contrary to knowledge, overall high level of good attitude was recorded (Table 7). Participants expressed positive and promising attitudes towards most attitudinal questions and statements. A very high percentage of participants agreed on the idea that the use of antibiotics requires a prescription in both human (79.1%) and livestock (69.1%). This is especially important due to the high prevalence in the level of antibiotic residues found in meat samples in a study conducted in Mount Lebanon (Bou-Mitri et al., 2019). However, the lack of appropriate attitude among 29.0 % of participants not having any objection to the use of antibiotics in agriculture maybe a consequence of poor knowledge and inadequate economic conditions of public in rural regions.

As for the association with demographic variables, gender, education and age significantly influenced the attitudes of participants (Table 7). When considering the level of education, the difference was most evident between participants with higher education and those with less educational level, the former showing higher rates of correct attitudes regarding antibiotic usage.

With respect to practice, overall, moderate level is scored (65.8%) (Table 7). A high percentage of participants followed the doctors' advice (92.3%) and got their antibiotics from pharmacies (87.6%). As for the frequency of use, the high % of participants reporting their latest use of AB during a period of one to six months prior to this survey, reflects high use frequency. That maybe directly linked to antibiotic resistance (Costelloe et al., 2010; Miller et al., 2018; Oldenburg et al., 2020).

Notably, the widespread usage of antibiotics like Amoxicillin, Erythromycin, Ciprofloxacin, Azithromycin, and Levofloxacin, as well as a few others, is high since these antibiotics have the largest spectrum of action currently available.

Despite the moderate overall score of practice, the high percentages of participants reporting several inappropriate practices are much higher of those reported in the urban district of the capital city of Beirut (Mallah et al., 2020; Mouhieddine et al., 2015). In addition, better level of good practices was noted in Beirut as 65% of participants got their antibiotics by a doctor prescription, whereas this score reached 10.9% only in Bekaa. These wide variations are in line with the general consensus that antibiotic use can be influenced by several demographic and socioeconomic factors amongst others factors (Obermeyer et al., 2002; Masiero et al., 2010). These factors should be kept in mind when policies and campaigns targeting general public to rationalize antibiotics use are designed and implemented.

In addition, the significant influence of being female, young and educated (Table 7) may be explained by the fact that women unlike men generally frame health issues by taking greater responsibility for childcare provision (You et al., 2008). Participants with higher education had more appropriate practices, a finding consistent with other studies (Barah & Goncalves, 2010; Nepal et al., 2019).

The weak to moderate positive correlations revealed between knowledge, attitude and practice indicates some direct significant relationship between these three components related to antibiotic use (Table 8). Such weak to moderate correlations maybe explained by certain dissonances revealed between knowledge on one hand, attitude and practice on another hand which could be mostly due to bias of participants responses.

Today, while many countries are focusing on public education and awareness aimed at promoting knowledge of public to address resistance to antibiotics (Mason et al., 2018; Redfern et al., 2020; Thong et al., 2021; WHO, 2016). Some research has reported that promoting the knowledge of public alone may not necessarily prevent misuse (McNulty et al., 2007). It is argued that developing clear guidelines for medical practitioners may provide a more effective approach to rationalize the use of antibiotics ultimately leading to reversing the current trend of increased resistance (Amábile-Cuevas, C. 2010).

According to the above discussed, findings indicate that antibiotic use by the rural communities of Bekaa region shows wide variations as compared to urban communities of Beirut city and its surroundings. It is therefore critical not generalize outputs of KAP studies administered on urban populations and to consider conducting a comprehensive national study that spans all across the country.

Findings also suggest that improving knowledge of uneducated segments of population with particular emphasis on females may be important for efforts to reduce the misconceptions and misguided expectations contributing to inappropriate antibiotic use. The integration of learning objectives regarding antibiotics can represent an opportunity to increase knowledge of

rational use of antibiotic among future generations. Community-based intervention activities can also be effective in enhancing public awareness.

While providing important information on the use of antibiotics in a rural region of Lebanon, the present study has several limitations. A possible limitation of this study is the fact that face-to-face interviews could lead to selection bias, given that the most introspective persons are less prone to participate in the survey. Another limitation is the fact that survey included very few questions about the use of antibiotic in livestock. More comprehensive research is required to uncover detailed aspects that affect antibiotic use in agriculture sector.

5. CONCLUSION

This study provides a baseline of KAP regarding antibiotics in a rural community from Lebanon. It showed that the study population had poor knowledge toward antibiotic uses in terms of their misuse in treating diseases, medication interruption, self-medication and sharing of antibiotics. However, good attitudes, as well as moderate practices were revealed. Some irrational practices with respect to obtaining antibiotics OTC without a prescription and frequent use were prevalent. Influences of socioeconomic factors as gender, age and education are revealed. The correlation analysis expressed a weak to moderate positive relationship between knowledge, attitude and practice. A comparison with the findings of a study on general public from Beirut capital city and its surrounding reveals wide differences making generalization based on findings of either regions inappropriate. This study provides science-based knowledge to guide actions and measures targeting rural areas with particularly emphasis on uneducated segments and females towards promoting rational use of antibiotics. With this intention, the enforcement of the Lebanese law is highly necessary. The study calls for more comprehensive comparative analysis covering different parts of the country.

REFERENCES

- Adedeji, W. A. (2016). The treasure called antibiotics. Annals of Ibadan Postgraduate Medicine, *14*(2), 56–57.
- Almakki, A., Jumas-Bilak, E., Marchandin, H., & Licznar-Fajardo, P. (2019). Antibiotic resistance in urban runoff. Science of the Total Environment, 667, 64–76.
- Al Mohammed R., & Bird E. (2019). Public knowledge and behaviours relating to antibiotic use in Gulf Cooperation Council countries: A systematic review
- Amábile-Cuevas, C. (2010). Antibiotic resistance in Mexico*: A brief overview of the current status and its causes—PubMed*. Retrieved from pubmed.ncbi.nlm.nih.gov
- Awad, A. I., & Aboud, E. A. (2015). Knowledge, Attitude and Practice towards Antibiotic Use among the Public in Kuwait. *PLOS ONE*, *10*(2), e0117910.
- Barah, F., & Goncalves, V. (2010). Antibiotic use and knowledge in the community in Kalamoon, Syrian Arab Republic: A cross-sectional study. *Eastern Mediterranean Health Journal*, *16*(05), 516–521.
- Bassoum, O., Sougou, N. M., Diongue, M., Lèye, M. M. M., Mbodji, M., Fall, D., Seck, I., Faye, A., & Tal-Dia, A. (2018). Assessment of General Public's Knowledge and Opinions towards Antibiotic Use and Bacterial Resistance: A Cross-Sectional Study in an Urban Setting, Rufisque, Senegal. *Pharmacy: Journal of Pharmacy Education and Practice*, *6*(4).
- Bonine, N. G., Berger, A., Altincatal, A., Wang, R., Bhagnani, T., Gillard, P., & Lodise, T. (2019). Impact of Delayed Appropriate Antibiotic Therapy on Patient Outcomes by Antibiotic Resistance Status From Serious Gram-negative Bacterial Infections. *The American Journal of the Medical Sciences*, *357*(2), 103–110.
- Bou-Mitri, C., Boutros, P. H., Makhlouf, J., Jaoudeh, M. A., Gerges, N. E., Fares, J. E. H., Yazbeck, E. B., & Hassan, H. (2019). Exposure assessment of the consumers living in Mount Lebanon directorate to antibiotics through medication and red meat intake: A cross-sectional study. *Veterinary World*, *12*(9), 1395–1407.
- Caudell, M. A., Dorado-Garcia, A., Eckford, S., Creese, C., Byarugaba, D. K., Afakye, K., Chansa-Kabali, T., Fasina, F. O., Kabali, E., Kiambi, S., Kimani, T., Mainda, G., Mangesho, P. E., Chimpangu, F., Dube, K., Kikimoto, B. B., Koka, E., Mugara, T., Rubegwa, B., & Swiswa, S. (2020). Towards a bottom-up understanding of antimicrobial use and resistance on the farm: A

knowledge, attitudes, and practices survey across livestock systems in five African countries. *PLOS ONE*, *15*(1), e0220274.

- Cheaito, L., Azizi, S., Saleh, N., & Salameh, P. (2014). Assessment of self-medication in population buying antibiotics in pharmacies: A pilot study from Beirut and its suburbs. *International Journal of Public Health*, *59*(2), 319–327.
- Costelloe, C., Metcalfe, C., Lovering, A., Mant, D., & Hay, A. D. (2010). Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: Systematic review and meta-analysis. In *Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]*. Centre for Reviews and Dissemination (UK). Retrieved from www.ncbi.nlm.nih.gov
- Gelband, H., & Delahoy, M. (2014). *Policies to Address Antibiotic Resistance in Low- and Middle-Income Countries*.
- Hawkings, N. J., Butler, C. C., & Wood, F. (2008). Antibiotics in the community: A typology of user behaviours. *Patient Education and Counseling*, *73*(1), 146–152.
- Higuita-Gutiérrez, L. F., Roncancio Villamil, G. E., & Jiménez Quiceno, J. N. (2020). Knowledge, attitude, and practice regarding antibiotic use and resistance among medical students in Colombia: A cross-sectional descriptive study. *BMC Public Health*, *20*(1), 1861.
- IDAL - Lebanon at a Glance—Invest in Regions—Baalbeck El-Hermel Governorate. IDAL.COM.
- Jammoul, & Darra, N. (2019). Evaluation of Antibiotics Residues in Chicken Meat Samples in Lebanon. *Antibiotics*, *8*, 69.
- Khalifeh, M., Moore, N., Salameh, P. (2017). Self-medication misuse in the Middle East: a systematic literature review. Pharmacol Res Perspect. 2017 Aug; 5(4): e00323. Published online 2017 Jun 18.
- Laxminarayan, R., Bhutta, Z., Duse, A., Jenkins, P., O'Brien, T., Okeke, I. N., Pablo-Mendez, A., & Klugman, K. P. (2006). Drug Resistance. In D. T. Jamison, J. G. Breman, A. R. Measham, G. Alleyne, M. Claeson, D. B. Evans, P. Jha, A. Mills, & P. Musgrove (Eds.), *Disease Control Priorities in Developing Countries* (2nd ed.). World Bank. Retrieved www.ncbi.nlm.nih.gov
- Ling Oh, A., Hassali, M. A., Al-Haddad, M. S., Syed Sulaiman, S. A., Shafie, A. A., & Awaisu, A. (2011). Public knowledge and attitudes towards antibiotic usage: A cross-sectional study among the general public in the state of Penang, Malaysia. *Journal of Infection in Developing Countries*, *5*(5), 338–347.
- LRBMS. (2012). Volume 1 Problems and Action Plan- English.pdf.
- Mallah, N., Badro, D. A., Figueiras, A., & Takkouche, B. (2020). Association of knowledge and beliefs with the misuse of antibiotics in parents: A study in Beirut (Lebanon). *PLOS ONE*, *15*(7), e0232464.
- Masiero, G., Filippini, M., Ferech, M., & Goossens, H. (2010). Socioeconomic determinants of outpatient antibiotic use in Europe. *International Journal of Public Health*, *55*(5), 469–478.
- Mason, T., Trochez, C., Thomas, R., Babar, M., Hesso, I., & Kayyali, R. (2018). Knowledge and awareness of the general public and perception of pharmacists about antibiotic resistance. *BMC Public Health*, *18*(1), 711.
- McNulty, C. A. M., Boyle, P., Nichols, T., Clappison, P., & Davey, P. (2007). Don't wear me out—The public's knowledge of and attitudes to antibiotic use. *The Journal of Antimicrobial Chemotherapy*, *59*(4), 727–738.
- Meena, H., Kumar, V. (2019).Antimicrobial Resistance and Rational Use of Antimicrobials in Livestock: Developing Countries' Perspective | IntechOpen.
- Miller, J. E., Wu, C., Pedersen, L. H., de Klerk, N., Olsen, J., & Burgner, D. P. (2018). Maternal antibiotic exposure during pregnancy and hospitalization with infection in offspring: A population-based cohort study. *International Journal of Epidemiology*, *47*(2), 561–571.
- Mouhieddine, T. H., Olleik, Z., Itani, M. M., Kawtharani, S., Nassar, H., Hassoun, R., Houmani, Z., Zein, Z. E., Fakih, R., Mortada, I. K., Mohsen, Y., Kanafani, Z., & Tamim, H. (2015). Assessing the Lebanese population for their knowledge, attitudes and practices of antibiotic usage. *Journal of Infection and Public Health*, *8*(1), 20–31.

- Nepal, A., Hendrie, D., Robinson, S., & Selvey, L. A. (2019). Knowledge, attitudes and practices relating to antibiotic use among community members of the Rupandehi District in Nepal. *BMC Public Health*, *19*(1), 1558.
- Obermeyer, CM., Schulein, M., Kasparian, C., & Ammar, W. (2002). Medication use, gender, and socio-economic status in Lebanon: Analysis of a national survey. *Le Journal Medical Libanais. The Lebanese Medical Journal*, *50*(5–6), 216–225.
- Oldenburg, C. E., Hinterwirth, A., Sié, A., Coulibaly, B., Ouermi, L., Dah, C., Tapsoba, C., Cummings, S. L., Zhong, L., Chen, C., Sarkar, S., Bärnighausen, T., Lietman, T. M., Keenan, J. D., & Doan, T. (2020). Gut Resistome After Oral Antibiotics in Preschool Children in Burkina Faso: A Randomized, Controlled Trial. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*, *70*(3), 525–527.
- Pouwels, K. B., Hopkins, S., Llewelyn, M. J., Walker, A. S., McNulty, C. A., & Robotham, J. V. (2019). Duration of antibiotic treatment for common infections in English primary care: Cross sectional analysis and comparison with guidelines. *BMJ*, *364*, l440.
- Redfern, J., Bowater, L., Coulthwaite, L., & Verran, J. (2020). Raising awareness of antimicrobial resistance among the general public in the UK: The role of public engagement activities. *JAC-Antimicrobial Resistance*, *2*(dlaa012).
- Sakr, S., Ghaddar, A., Hamam, B., and Sheet, I. (2020). Antibiotic use and resistance: an unprecedented assessment of university students' knowledge, attitude and practices (KAP) in Lebanon. BMC Public Health, 19 Apr 2020, 20(1):535
- Salameh, P., Sacre, H., Hallit, S., Hajj, A. (2017). Antibiotic resistance in Lebanon
- Sample Size Calculator by Raosoft, http://www.raosoft.com/samplesize.html
- Shaikhan, F., Rawaf, S., Majeed, A., & Hassounah, S. (2018). Knowledge, attitude, perception and practice regarding antimicrobial use in upper respiratory tract infections in Qatar: A systematic review. *JRSM Open*, *9*(9), 2054270418774971.
- Thong, K. S., Chang, C. T., Lee, M., Lee, J. C. Y., Tan, H. S., & Shafie, A. A. (2021). Impact of targeted educational intervention towards public knowledge and perception of antibiotic use and resistance in the state of Perak, Malaysia. *Antimicrobial Resistance & Infection Control*, *10*(1), 29.
- Tshokey, T., Adhikari, D., Tshering, T., Wangmo, S., & Wangdi, K. (2017). Assessing the Knowledge, Attitudes, and Practices on Antibiotics Among the General Public Attending the Outpatient Pharmacy Units of Hospitals in Bhutan: A Cross-Sectional Survey. *Asia Pacific Journal of Public Health*, *29*(7), 580–588.
- Voidăzan, S., Moldovan, G., Voidăzan, L., Zazgyva, A., & Moldovan, H. (2019). Knowledge, Attitudes And Practices Regarding The Use Of Antibiotics. Study On The General Population Of Mureş County, Romania. *Infection and Drug Resistance*, *Volume 12*, 3385–3396.
- WHO. (2020). Antibiotic resistance. Retrieved from www.who.int
- WHO (2015). Antibiotic Resistance: Multi-Country Public Awareness Survey.
- WHO (2016).Awareness and education. Retrieved from www.who.int
- WHO. (2009).Health literacy and health promotion. Retrieved from www.who.int/healthpromotion/conferences/7gchp/Track1_Inner.pdf
- WHO. (2018). Tackling-amr-together-working-paper-5-genderandequity-sept2018-en.pdf.from cdn.who.int
- Yaacoub, S. G., Lahoud, N. A., Francis, N. J., Rahme, D. W., Murr, T. H., Maison, P. F., & Saleh, N. G. (2019). Antibiotic Prescribing Rate in Lebanese Community Pharmacies: A Nationwide Patient-Simulated Study of Acute Bacterial Rhinosinusitis. *Journal of Epidemiology and Global Health*, *9*(1), 44.
- You, J. H. S., Yau, B., Choi, K. C., Chau, C. T. S., Huang, Q. R., & Lee, S. S. (2008). Public knowledge, attitudes and behavior on antibiotic use: A telephone survey in Hong Kong. *Infection*, *36*(2), 153–157.
- Zahreddine, L., Hallit, S., Shakaroun, S., Al-Hajje, A., Awada, S., & Lahoud, N. (2018). Knowledge of pharmacists and parents towards antibiotic use in pediatrics: A cross-sectional study in Lebanon. *Pharmacy Practice*, *16*(3), 1–10.