Maternal knowledge and prescribing practices of antibiotics for childhood infections: a cross-sectional survey in Jordan

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Abstract

This article aims to assess the knowledge and practices of Jordanian mothers regarding antibiotic consumption by their children. A questionnaire was distributed to mothers during hospital visits in February-May 2020. Questions were on socio-demographics; knowledge of antibiotic indications/complications; and prescribing practices. A total of 1926 mothers participated. Most mothers were aware that antibiotics are not indicated for viral infections (72.0%), and that abuse leads to complications like antibiotic resistance (82.1%). However, their knowledge regarding antibiotic complications was not satisfactory particularly complications of obesity (11.7%), caries (29.9%), and allergy (43.4%). The most important clinical indications for antibiotics were perceived to be otitis media (89.8%), and sore throat (44.4%). A proportion of 21.7% admitted self-prescribing, significantly among families of ≤2 children, and poor antibiotic knowledge ($p<0.01$). Lower antibiotic knowledge scores were impacted mostly by grandparents who self-prescribe antibiotics ($p<0.01$). Jordanian mothers show satisfactory knowledge of pediatric antibiotic consumption, however, their knowledge of complications is not sufficient. Antibiotic self-prescribing is identified mainly in families with lower income and less antibiotic knowledge, therefore these families should be identified and targeted in antibiotic awareness campaigns.

Introduction

Children may use substantial amounts of antibiotics due to their high susceptibility to infections, particularly those affecting the upper respiratory tract. Exposure of children to factors that predispose them to infections is promoted by the surrounding environment such as nurseries, daycare facilities, and schools which facilitate the spread of antibiotic-resistant bacteria.[1] Although a substantial proportion of childhood illnesses are viral in origin, it is estimated that 78% of children with acute upper respiratory tract infections (AURIs) receive antibiotic prescriptions that are mostly based on broad-spectrum antibiotics.[2] Misuse of antibiotics in children has been associated with the development of several complications particularly antibiotic resistance which has many serious consequences including increased mortality.[3,4]

Situated in the heart of a turbulent Middle East, Jordan represents a politically stable country that continues to host refugees, immigrants, and workforce from neighboring countries such as Palestine, Syria, Iraq, Egypt, Yemen, and more recently Sudan.[5] It is estimated that more than 40% of the Jordanian population, or 3.8 million, are children; approximately 30% of these are of non-Jordanian origin. This may represent a real challenge for the national healthcare system which may be burdened by the fluctuating demographics and the associated challenges of drug prescribing and use.

Previous research in Jordan and the neighboring countries of the Eastern Mediterranean showed several alarming findings regarding antibiotic abuse including their unjustified use for viral infections, parental pressure in prescribing, and excessively long antibiotic courses.[2,6,7] It is estimated that approximately 77.5% of prescriptions to the outpatient pediatric population are antimicrobials.[8] It was also concluded that pneumococcal carriage rate and resistance among 2- to 4-year-old children reached an alarming rate.[9] Another important finding was the noticeable impact of social factors and parental involvement in treatment plans which were identified in this geographic region.[10]

Since antibiotics are among the most commonly used drugs by the pediatric population, and considering the influence of mothers in the consumption of antibiotics, and shaping prescribing practices of clinicians, it is crucial to investigate their knowledge and self-prescribing practices of antibiotics.

Therefore, this cross-sectional survey aims to evaluate the knowledge and practices of Jordanian mothers regarding antibiotic consumption by their children.

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Materials and Methods

The study was a questionnaire-based cross-sectional survey. The questionnaire was a modified version of a similar questionnaire used in a previous study.[11] It was composed of 36 closed-ended questions and organized into three sections. The first section consisted of six questions on socio-demographics. The second section consisted of 19 knowledge questions answered by (Yes, No, Don't know), and eight questions on appropriate antibiotic uses answered by (Yes, No). There were five knowledge ques-

tions on five types of common childhood medications and whether these constitute antibiotics. These types included the following drug categories with common locally recognized brand names (Penicillins: Augmentin, Amoclan, Curam; Cephalosporins: Suprax, Cefix, Omnicef; Macrolides: Zomax, Azicure; Non-steroidal anti-inflammatory agents: Brufen/ Aspirin; Corticosteroids: Decadron, Predone). The third section consisted of prescribing aspects specifically antibiotic storage for future use and self-prescribing by parents and grandparents. Questionnaire items were entered onto Google Forms and a link was created. Ethical approval was obtained from the Ibn Alhaitham Hospital, Amman, Jordan. Mothers who attended the hospital for treatment of their children were invited in a consecutive order to participate in the study. Those who gave their consent received the link for the questionnaire on their smartphones and they were guided throughout the questionnaire by the investigators without influencing their responses. Invitation of the participants and the questionnaires were completed in four months from February 1st, 2020 to May 31st, 2020.

Knowledge and practice answers were scored by assigning one mark for each appropriate answer (whether yes or no) while the incorrect and the "don't know" answers were marked by "zero". Questions about understanding antibiotics and their

Table 1. Sociodemographic characteristics of mothers (N=1926) participating in the survey and their families.

Sociodemographic characteristics	No (%)	
Marital status		
Married	1905 (98.9)	
Divorced	19 (1.0)	
Widowed	2 (0.1)	
Residence		
Urban	1713 (88.9)	
Rural	213 (11.1).	
Health insurance		
Yes	1425 (74.0)	
No	501 (26.0)	
Monthly household income (JOD)		
Low (<500)	476 (24.7)	
Moderate (500-1000)	732 (38.0)	
High (>1000)	718 (37.3)	
Education of parents	Mothers	Fathers
School	189 (9.8)	396 (20.6)
College	209 (10.9)	191 (9.9)
University	1310 (68.0)	1048 (54.4)
Postgraduate	218 (11.3)	291 (15.1)

JOD, Jordanian Dinar (equivalent to 1.41 USD).

Table 2. Knowledge and prescribing practices of antibiotics for children among participating mothers.

Knowledge and practice items		Frequency (%)		
		Yes	No	Don't know
Knowledge: indications, advantages, complications	ABs are useful for viral infections	438 (22.7)	1386 (72.0)*	102 (5.3)
	ABs are indicated for bacterial infection	1583 (82.2)*	187 (9.7)	156 (8.1)
	ABs abuse complicates treatment	1582 (82.1)*	177 (9.2)	167 (8.7)
	ABs abuse causes bacterial resistance	1596 (82.9)*	258 (13.4)	72 (3.7)
	Expensive ABs are more effective	336 (17.4)	1353 (70.2)*	237 (12.3)
	New ABs are more effective	516 (26.6)	614 (31.7)	809 (41.7)
	ABs may induce obesity in children	226 (11.7)*	473 (24.6)*	1227 (63.7)
	ABs may induce dental caries	575 (29.9)*	414 (21.5)	937 (48.7)
	ABs may induce sensitivity	835 (43.4)*	347 (18.0)	744 (38.6)
	ABs may induce diarrhea	1342 (69.7)*	188 (9.8)	396 (20.6)
	ABs enhance child recovery	1216 (63.1)*	631 (32.8)	79 (4.1)
	ABs ease flu	269 (14.0)	1563 (81.2)*	94 (4.9)
	ABs abuse makes future use difficult	1456 (75.6)*	272 (14.1)	198 (10.3)
	ABs should be stopped after recovery	171 (8.9)	1733 (90.0)*	22 (1.1)
	Palatable ABs are better	330 (17.1)	1548 (80.4)*	48 (2.5)
Knowledge: These medications are ABs	Penicillins	1551 (80.5)*	375 (19.5)	0
	Cephalosporins	1441 (74.8)*	485 (25.2)	0
	Macrolides	1069 (55.5)*	857 (44.5)	0
	Corticosteroids	269 (14.0)	1657 (86.0)*	0
	NSAIDS	113 (5.9)	1813 (94.1)*	0
Prescribing Practices	I have a background on childhood infections	1397 (72.5)	528 (27.5)	NA
	I use ABs for sore throat	855 (44.4)	1071 (55.6)	NA
	I use ABs for flu	105 (5.5)	1821 (94.5)	NA
	I use ABs for diarrhea	152 (7.9)	1774 (92.1)	NA
	I use ABs for fever	699 (36.3)	1227 (63.7)	NA
	I use ABs for otitis media	1729 (89.8)	197 (10.2)	NA
	I use ABs for dental pain and caries	236 (12.3)	1690 (87.7)	NA
	I prescribe Abs to my children	417 (21.7)	1509 (78.3)	NA
	Grandparents prescribe ABs to my children	460 (23.9)	1466 (76.1)	NA
	I store ABs for future use	417 (21.7)	1509 (78.3)	NA

ABs: Antibiotics; NA: Not applicable; Penicillins: Augmentin, Amoclan, Curam; Cephalosporins: Suprax, Cefix, Omnicef; NSAIDS: Brufen/ Aspirin; Corticosteroids: Decadron, Predone; and Macrolides: Zomax, Azicure.
*Correct statements

indications were marked for all participants and were calculated as knowledge scores for antibiotics. The sum of all marks for each participant comprised the total score in antibiotics knowledge. Statistical analysis was performed using the IBM SPSS software version 21.0 (Armonk, NY: IBM Corp). Analysis was done to obtain descriptives in the form of frequencies and percentages. Cross-tabulation was performed to determine significant associations between sociodemographics on the one hand and antibiotic knowledge scores and self-prescribing practices on the other hand. The level of significance was set at P≤0.05. Multiple linear regression was carried out to investigate significant factors influencing knowledge scores.

Results

Socio-demographics of the sample

A total of (1926) mothers participated in the survey. Sociodemographic characteristics of marital status, number of children in the family, education status of parents, availability of medical insurance, and other sociodemographics of the sample are presented in Table 1. Most of the sample were married (98.9%), urban dwellers (88.9%), had health insurance (74.0%), and had moderate-high income (75.3%). A higher percentage of mothers than fathers (90.2% versus 79.4%) had higher education.

Items related to knowledge and practice about antibiotics use among children are shown in Table 2 together with the responses of participants.

Knowledge scores ranged from a minimum (3) to a complete score of (27) with a mean value of (19.4±3.4). Accordingly, scores ≤18 were considered low, while scores >18 were considered high scores. Knowledge items with the highest correct response rate (>82%) were: ABs are indicated for bacterial infection, AB abuse complicates treatment, and AB abuse causes bacterial resistance. On the other hand, knowledge items with the highest "Don't know" response rate were: antibiotics may induce obesity and dental caries in children (63.7% and 48.7% respectively) (Table 2).

Approximately 22.0% of the sample practiced antibiotic self-prescribing for their children and storing medications for future use. A higher percentage of grandparents (23.9%) than mothers (21.7%) prescribed antibiotics to their grandchildren (Table 2). The practice of self-prescribing was cross-tabulated with sociodemographic factors and total knowledge scores. Results are presented in (Table 3). Health insurance was found to be the only variable not significantly correlated to self-prescribing behavior (p=0.068). Having ≤2 children, low antibiotic knowledge scores, parents' university education level, urban residence, low-middle income, and self-prescribing grandparents were all significantly associated with the practice of antibiotic self-medication among participants (p<0.05) (Table 3). Results of cross-tabulation between antibiotic knowledge scores and sociodemographic factors are displayed in Table 4.

There were significantly higher antibiotic knowledge scores when: parents' education was university (p=0.000 for both), urban residence (p=0.002), having health insurance (p=0.002), non-prescribing grandparents (p=0.000) and moderate-high household income (p=0.000) (Table 4).

For the regression model (Table 5) an "ENTER" method was implemented and independent variables were identified as follows: Monthly household income, Number of children in the family, Prescribing grandparents, Health insurance, Residence, Mother's education, and

Table 3. Cross-tabulation of sociodemographics with the practice of antibiotic self-medication among participating mothers.

Sociodemographics	Do you prescribe ABs to your children? No N=1509 (%)	Yes N=417 (%)	p
Number of Children in the family			
1-2	1121 (74.3)	246 (59)	0.000
> 2	388 (25.7)	171 (41)	
AB knowledge ranks			
Low (≤18)	442 (29.3)	249 (59.7)	
Good (> 18)	1067 (70.7)	168 (40.3)	0.000
Mother education			
School	122 (8.1)	67 (16.1)	0.000
College	153 (10.1)	56 (13.4)	
University	1051 (69.6)	259 (62.1)	
Higher education	183 (12.1)	35 (8.4)	
Father education			
School	262 (17.4)	134 (32.1)	0.000
College	144 (9.5)	47 (11.3)	
University	868 (57.5)	180 (43.2)	
Higher education	235 (15.6)	56 (13.4)	
Residence			
Rural	144 (9.5)	69 (16.5)	0.000
Urban	1365 (90.5)	348 (83.5)	
Health insurance			
No	378 (25)	123 (29.5)	0.068
Yes	1131 (75)	294 (70.5)	
Grandparent/s prescribe/s ABs			
No	1172 (77.7)	294 (70.5)	0.003
Yes	337 (22.3)	123 (29.5)	
Monthly household income			
Low	316 (20.9)	160 (38.4)	0.000
Middle	572 (37.9)	160 (38.4)	
High	621 (41.2)	97 (23.3)	

Father's education. The "ENTER" method used forced all variables into the regression model. The results of multiple linear regression are shown in Table 5. Significant variables in the model were: monthly income, prescribing grandparents, father's education, and mother's education ($p<0.01$). All other variables were not significant ($p>0.05$). Regression analysis showed an R-value of 0.325, $R^2=0.106$, and adjusted $R^2=0.102$ (close to the R square value indicated that the sample size was satisfactorily sufficient). Durban Watson test value of 1.919 indicated that 10.6% of the variability in antibiotics knowledge scores could be accounted for by variations of independent variables in the model. Durban Watson test value was > 1.5 indicating that we do not have meaningful serial correlation or multicollinearity between independent variables. ANOVA results indicated an $F=58.270$ and $p<0.001$. Coefficients in the regression model are shown in Table 5. Coefficients (B weights) show that grandparents' contribution to medication had the highest impact on AB knowledge scores which was a negative effect, indicating that prescribing grandparents were associated with knowledge scores that were lower by 0.904 score) followed by monthly income then mother's education and finally father's education. All entered variables were significant at $p\leq0.001$. Tolerance of more than 0.2 for all included variables indicated that multicollinearity is not an issue in this regression model.

Table 4. Cross-tabulation of sociodemographic characteristics with antibiotic knowledge scores among participating mothers.

	AB Knowledge score ranks of mothers		p
	Low (%)	Good (%)	
No of children			
1-2	475 (68.7)	892 (72.2)	0.116
> 2	216(31.3)	343 (27.8)	
Marital status			
Widow	1(0.1)	1 (0.1)	0.528
Married	681(98.6)	1224 (99.1)	
Divorced	9(1.3)	10 (0.8)	
Mother education			
School	116(16.8)	73 (5.9)	0.000
College	80(11.6)	129 (10.4)	
University	440(63.7)	870 (70.4)	
Higher education	55(8)	163 (13.2)	
Father education			
School	203(29.4)	193 (15.6)	0.000
College	82(11.9)	109 (8.8)	
University	334(48.3)	714 (57.8)	
Higher education	72(10.4)	219 (17.7)	
Residence			
Rural	97(14)	116 (9.4)	0.002
Urban	594(86)	1119 (90.6)	
Health insurance			
No	208(30.1)	293 (23.7)	0.002
Yes	483(69.9)	942 (76.3)	
Grandparents participating in medication			
No	480(69.5)	986 (79.8)	0.000
Yes	211(30.5)	249 (20.2)	
Monthly income			
Low	254(36.8)	222 (18)	0.000
Middle	262(37.9)	470 (38.1)	
High	175(25.3)	543 (44)	

Table 5. Coefficients in the regression model.

Independent variables	Unstandard. Coeff. B	Std. Error	Standard. Coeff. Beta	t	Sig.	95.0% Conf. Intervalfor B Lower	Upper	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolera	VIF
(Constant)	15.19	0.579		26.23	0	14.05	16.32					
Monthly income	0.708	0.117	0.161	6.07	0.000	0.479	0.936	0.269	0.137	0.131	0.660	1.515
No. of children	0.000	0.075	0	0.003	0.998	0.148	0.147	0.008	0	0.000	0.884	1.131
Self-prescribing Grandparents	0.904	0.175	0.113	5.16	0.000	1.248	0.560	0.156	0.117	0.111	0.969	1.032
Residence	0.448	0.250	0.041	1.79	0.073	0.042	0.939	0.108	0.041	0.039	0.881	1.136
Health insurance	0.066	0.178	.008	.370	.712	.416	.284	.071	.008	.008	.884	1.131
Mother's education	0.426	0.116	0.095	3.67	0	0.198	0.654	0.209	0.083	0.079	0.694	1.442
Father's education	0.308	0.094	0.088	3.27	0.001	0.124	0.493	0.226	0.075	0.071	0.647	1.547

a, Dependent Variable: Antibiotics knowledge scores.

Discussion

This study was conducted on a large sample of Jordanian mothers, the primary caregivers for children in Jordan to explore their knowledge of antibiotics, awareness of antibiotic uses and complications, and finally the self-prescribing practices towards their children. A close look at the sociodemographics of this sample indicates that more than 75% of the sample were settled financially and socially being mostly married, educated, with health insurance, and urban dwelling. It was interesting to identify that more mothers had college or higher education than fathers. This is undoubtedly a close representation of the actual data that report that approximately 56% of students in Jordanian universities are women.[12] Perhaps that is why most respondents had good knowledge about the uses and complications of antibiotics as most of them believed that antibiotics are not indicated for viral infections and that antibiotics should be used for bacterial infections. This reflects that Jordanian mothers have acceptable levels of awareness regarding the main uses of antibiotics. This was further confirmed by >80% of the sample who acknowledged that antibiotic abuse is a problem that results in increasing antibiotic resistance and complicating treatment outcomes. It was important to explore mothers' knowledge of the possible complications of antibiotic use. Their knowledge is expected to increase their appreciation of the treatment outcomes that could be adverse making its avoidance necessary. However, not all participants were aware of some antibiotic complications known to affect the pediatric population. Whereas most participants agreed with the fact that antibiotics may induce diarrhea and sensitivity, a substantial proportion did not recognize that antibiotics may induce obesity or dental caries. This is perhaps related to the acute and prevalent nature of antibiotic-associated diarrhea which is estimated to be 11%.[13] Whilst, any antibiotic is capable of inducing diarrhea, the most common agent involved is amoxicillin followed by clindamycin because of the spectrum of action and widespread use.[14] Further, antibiotics use in children may be associated with the risk of developing allergies and asthma.[15] The association between asthma and antibiotic use has been debatable for a long period, however, in the past decade more studies emerged that concluded that excessive use of systemic antibiotics in infancy may play a role in the development of asthma in children.[16,17] Therefore, the association between antibiotic use in children and allergy and asthma cannot be overlooked. Other complications associated with less awareness among our sample included obesity and dental caries, probably due to the common belief of their association with nutritional and lifestyle factors. An association between antibiotic use on the one hand and obesity and dental caries on the other hand has been suggested previously.[18,19] A recent meta-analysis reported that early-life antibiotic exposure was associated with the risk of childhood overweight or obesity in a dose-response manner.[19] Children who are exposed to antibiotics early in their life may be at risk of changing the composition of their intestinal microbiota, with subsequent adverse long-term effects like obesity.[20] Therefore, with the high prevalence of obesity among children in Jordan,[21] more studies are warranted to investigate the role of antibiotics and other childhood medications as a contributory factor to obesity. On the other hand, several dental problems associated with pediatric antibiotic use are identified, and these when associated with the poor oral health practices common among children in the Eastern Mediterranean region[22] would worsen the oral health outcomes. It was also shown that exposure to amoxicillin during early infancy may predispose to dental defects in the form of defective enamel.[23]

Participants were generally knowledgeable about the antibiotic brand names prescribed to children locally in Jordan. However, a small percentage identified corticosteroids (14%) and NSAID analgesics (6%) as antibiotics probably because of their anti-inflammatory nature, and their versatile applications in the management of childhood infections.[24]

Regarding the effectiveness of antibiotics and associated factors, the study revealed that seven out of 10 respondents did not perceive that there was a relation between the cost of antibiotics and their effectiveness. On the other hand, 30% of respondents did not consider that new antibiotics are more effective as opposed to a slightly higher proportion of 40% who expressed uncertainty about the comparative effectiveness of new antibiotics. These results suggest that our respondents have a keen understanding of the price-quality relationship of drugs. However, it is worth noting that multiple studies have indicated that higher-priced drugs are often associated with higher efficacy judgment.[25] Clearly, new antibiotics have been developed to target more resistant strains of bacteria. Nevertheless, this does not imply that the older antibiotics are any less effective than the new ones against the original strains of bacteria.[26]

Participants used antibiotics to treat a variety of childhood infections and diseases. The most frequently cited diseases were otitis media followed by sore throat, while the least frequently cited diseases for antibiotics use were dental pain, diarrhea, and flu in descending order. This generally indicates good practice since operative treatment, for dental pain,[27] and palliative treatment for flu are the appropriate measures that should be followed rather than antibiotic consumption.

One in five of the participants practiced self-medication with their children. Self-medication with antibiotics is a serious common practice in Jordan and other Eastern Mediterranean populations.[10] A recent systematic review reported that the prevalence of antibiotic self-medication among children was highest in the Middle East and lowest in Europe.[28] It was noticed that small families (≤2 children), and low-middle income were significantly associated with this practice. This is consistent with recent systematic reviews that concluded that low income and having more than one child were associated with this practice.[29] Unfortunately, the non-prescribed dispensing of antibiotics in Jordan is not yet well-controlled, which facilitates obtaining medications for self-prescribing parents. This may have serious implications particularly that this practice was significantly associated with participants who had low antibiotic knowledge scores. Expectedly, there was a significant association between higher antibiotic knowledge scores and favorable socioeconomic status in terms of education, residence, health insurance, and monthly income. Education is usually paralleled by socioeconomic well-being, and both are generally associated with improved access and retrieval of required information about childhood medications. It was important to explore grandparents' involvement in the child's treatment plan because of the primary role that grandparents in Arabic societies play in contributing to their grandchildren's upbringing issues such as health aspects. Albeit the small difference, a higher percentage of grandparents than parents participated in self-medication. On the other hand, prescribing grandparents were significantly associated with prescribing mothers and mothers who had low antibiotic knowledge scores. This was confirmed by regression analysis which showed that self-prescribing grandparents had the strongest association with low knowledge scores of mothers followed by other less significant factors such as monthly income, and parents' education. This confirms previous findings of the essential role of the family in promoting health behaviors including appropriate drug use.[30] This study therefore showed that good antibiotic knowledge and

non-self-prescribing go hand in hand to leave the practice of prescribing to physicians to promote patient safety and avoid the anticipated side effects of antibiotic abuse.

The study has limitations. It was a single-center study conducted in a private city hospital. However, a large sample of mothers with different socioeconomic profiles has participated. The cross-sectional self-perceived nature of the survey may represent another limitation. However, the anonymous nature of the questionnaire and the assistance that researchers provided to participants during the completion of the survey are two main factors that helped provide reliable responses.

Conclusions

Jordanian mothers seem to have satisfactory knowledge of antibiotics consumed by their children. However, their knowledge of complications is not sufficient, and some of them show poor practices in obtaining the medication and practicing self-medication. Most parents showed their interest in improving their education on antibiotics issues, and this could be utilized to design parent-oriented interventions that increase the awareness of parents and improve antibiotic use among the pediatric population.

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