

Original Research

Awareness, knowledge, and behaviour of Jordanian public regarding misuse and overuse of proton pump inhibitors

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Abstract

Background: Proton pump inhibitors (PPIs) are frequently used for the treatment and prophylaxis of upper gastrointestinal tract disorders. PPIs are now frequently the first-choice treatment for people with diseases associated with acidity. **Objectives:** The aim of this study is to assess the awareness, knowledge, and behaviour of the Jordanian public regarding the misuse and overuse of proton pump inhibitors. **Methodology:** The survey was made with Google Forms and made available online through various social media channels. Using a practical sample technique and the snowball dissemination of the questionnaire, participants were recruited. Adulthood and residence in the Hashemite Kingdom of Jordan were requirements for inclusion. **Results:** A total of 418 participants responded and filled out the questionnaire, with an average age of 37.5 ± 14.2 years. almost one third experienced a GI disease, $n = 115$ (27.5%), but around half of the participants, 204 (48.8%), used at least one type of PPI. 88 (43.1%) of the participants who used the PPIs experienced vitamin B12 deficiency as the most frequent side effect. The knowledge score was calculated for participants; the overall knowledge score was very low (2.8/8); the lowest score was on the correct duration for PPI use (0.13/1). In the multivariate analysis, predictors of a higher score of knowledge were working in a medical field and a monthly income lower than 500 JD. **Conclusion:** Findings from this study demonstrated that the overall knowledge score for Jordanians was low, which indicates that the Jordanian public is unaware of the PPIs correct use and possible side effects. Hence, with the dramatic increase in PPIs use, educational initiatives and programs are required to enhance public knowledge, particularly among those with non-medical educational backgrounds and monthly income above 500 JD.

Keywords: proton pump inhibitors (PPIs/PPI); awareness; knowledge; behaviour web-based survey; Jordan

INTRODUCTION

Proton pump inhibitors (PPIs) are frequently medicated for the prophylaxis and treatment of upper gastrointestinal tract disorders.¹

Since the first PPI, omeprazole, was introduced in 1989,² and subsequent PPIs in the class, including lansoprazole, pantoprazole, rabeprazole, and esomeprazole, have been commercialized, there has been a significant, ongoing, and mysterious increase in the prescribing of PPIs.³ PPIs are now frequently the first-choice treatment for people with diseases associated with acidity.⁴ PPIs continue to be among the most commonly prescribed drugs in the world in the United States,⁵ where they were prescribed to 4% of outpatients in 2002 and 9.2% in 2009, with sales of PPIs totaling about \$10

billion in 2007 and \$13.9 billion with 113 million prescriptions filled on an annual basis in 2010.⁶

Moreover, since 1999 until nowadays, some of the known PPIs, like omeprazole and esomeprazole, have been categorized as over-the-counter (OTC) drugs.⁷ Medications for the digestive system alone were worth \$4.3 billion in the United States in 2016 due to the fact that OTC pharmaceuticals are known for their usage for a brief length of time, for a confirmed indication, and with a low risk potential for the patient.^{8,9}

The purpose of the study is to assess the awareness, knowledge, and behaviour of the Jordanian public regarding the misuse and overuse of proton pump inhibitors. The importance of this study depends on the fact that there are few studies on the misuse of PPIs by the general population in Jordan regarding their prescription antecedents, consumption patterns, concurrent drugs, the percentage of inappropriate use, the extent of use, and any long-term complications.

METHOD

Study design, setting, and participants

This will be a prospective cross-sectional study using a structured online survey. The sample size is determined using Raosoft,¹⁰ with the settings at a minimum sample size of 385, 95% confidence, and 5% error. Our target is all adults (18 years of age and older) who are living in Jordan.

Data collection

Data on participant awareness, knowledge, and behavior

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about proton pump inhibitors (PPIs) was gathered over the course of seven months using a structured online survey (August 2022-February 2023). The preliminary survey was approved by specialists, and changes were made in response to their recommendations. Three components made up the questionnaire. The consent received to take part in this study was included in the first section. The gathered social and demographic information was covered in the second section. Measurements of participant awareness, knowledge, and behavior about the use of PPIs, common side effects, and the occurrence of any complications were included in the third section.

Ethical approval was obtained, and following the ethical approval, the online link to the questionnaire was created using Google Forms and sent via social media and WhatsApp platforms. Participants were recruited through a convenient sampling method and snowball distribution of the questionnaire (which is considered a limitation of this study). Participants were invited to voluntarily and anonymously complete and then submit their responses. Participation was optional; consenting by the participants was done at the beginning of the survey using an introductory paragraph that informed them about the study objectives; the questionnaire was opened only if the participants agreed to participate in this study.

The Statistical Package for Social Sciences (SPSS) was used to conduct the statistical analysis. In the case of continuous data, means and standard deviations (SD) were displayed. Absolute and relative frequencies were used to calculate the difference in knowledge scores between the groups for categorical data. The relationship between sociodemographic variables, knowledge scores, and the use of PPIs was examined using the chi-square test. Significance thresholds were established at $P < 0.05$.

RESULTS

A total of 418 individuals answered the questionnaire, with a mean age of 37.5 years (SD = 14.2). Most of the participants did not suffer from any gastro-intestinal (GI) disease, $n = 264$ (63.2%), almost one third experienced a GI disease, $n = 115$ (27.5%), and few did not know, $n = 39$ (9.3%). Additionally, two thirds of the participants did not have an endoscopy procedure, $n = 321$ (76.8%), and only 97 participants (23.2%) did have an endoscopy. The sociodemographic characteristics of participants are shown in (Table 1).

Cardiovascular diseases and diabetes were the most common medical conditions, and consequently, antihypertensive agents and hypoglycemic drugs were the most commonly used medication (Table 2).

	Frequency (%)		Frequency (%)
Gender		Education level	
Male	122 (29.2%)	Less than high school	5 (1.2%)
Female	296 (70.8%)	High school	61 (14.6%)
Gender		Bachelor's degree or higher education	352 (84.2%)
Single	163 (38.9%)	Do you work in the medical field?	
Married	231 (55.3%)	Yes	141 (33.7%)
Divorced	11 (2.6%)	No	277 (66.3%)
Widowed	13 (3.1%)	Monthly income (Jordanian dinars, JOD)	
Nationality		Less than 500 JOD	202 (48.3%)
Jordanian	360 (86.1%)	More than 500 JOD	216 (51.7%)
Non-Jordanian	58 (13.9%)		
Do you have chronic medical conditions?			
No	288 (68.9%)		
Yes	130 (31.1%)		

Medical condition	No Frequency (%)	Yes Frequency (%)
Hypertension	359 (85.9%)	59 (14.1%)
Cardiovascular diseases (other than hypertension)	408 (97.6%)	10 (2.4%)
Diabetes	380 (90.9%)	38 (9.15%)
Liver diseases	415 (99.3%)	3 (0.7%)
Kidney diseases	414 (99.0%)	4 (1.0%)
Asthma or COPD	398 (95.2%)	20 (4.8%)
Others	364 (87.1%)	54 (12.9%)

Medication use		
Antihypertensive agents	361 (86.2%)	58 (13.8%)
Oral Hypoglycemic agents	382 (91.2%)	37 (8.8%)
Insulin	418 (99.8%)	1 (0.2%)
Clopidogrel	412 (98.3%)	7 (1.7%)
Antifungal agents	412 (98.3%)	7 (1.7%)
Medication for GI diseases	349 (83.3%)	70 (16.7%)

COPD= Chronic obstructive pulmonary disease, GI= Gastrointestinal

Frequency and pattern of proton pump inhibitors (PPIs) use

Almost half of the participants did not use the PPI 214 (51.2%) and 204 (48.8%) used at least one type of PPI. Of these, 141 (69.1%) used the drugs based on a prescription by a physician, 34 (16.7%) took the PPIs based on the pharmacist’s advice, and 29 (14.2%) used them as self-medication.

Participants used different types of PPIs: 18 (8.8%) used rabeprazole, 81 (39.7%) used omeprazole, 103 (50.5%) used esomeprazole, and 71 (34.8%) used lansoprazole.

Concerning the type of information that the participants received from the pharmacist, 136 (66.7%) were told the best time to take the drug, 76 (37.3%) were told the duration of PPI use, 38 (18.6%) were told the side effects, 22 (10.8%) were told certain drug interactions, and 41 (20.1%) were not told any of the previous information.

Participants suffered from certain side effects: 67 (32.8%) suffered from headaches, 59 (28.9%) experienced constipation, 56 (27.5%) suffered from diarrhea, and 9 (4.4%) suffered from pneumonia. Sixteen participants used PPIs and had osteoporosis.

Participants who used the PPIs suffered mainly from vitamin B 12 deficiency 88 (43.1%), followed by hypocalcemia 26 (12.7%), hypomagnesemia 17 (8.3%), and vitamin D deficiency 16 (7.8%).

Most of the participants who used the PPIs and suffered from deficiencies did not take any action. 79 (38.7%), 102 (52.9%) took supplements, 35 (17.2%) sought physician’s or pharmacist’s advice, and 8 (3.9%) stopped the PPIs.

The knowledge score was calculated for participants; the lowest score was the correct duration for nonprescription PPI use (Table 3).

Indications for the use of PPIs included heartburn (n = 96, 22.9%), peptic ulcer (n = 48, 11.5%), gastroesophageal reflux disease (n = 44, 10.5%), helicobacter pylori infection (n = 37, 8.9%), gastritis (n = 31, 7.4%), esophagitis (n = 14,), hoarseness (n = 12, 3.4%), hiatal hernia (n = 12, 2.9%), sore throat (n = 12, 2.9%), gastroenteritis (n = 11, 2.6%), after bariatric surgery (n = 9, 2.2%), and asthma (n = 3, 0.7%).

Possible predictors of a higher knowledge score were assessed using univariate and multivariate linear regression. Participants who worked in the medical field had a knowledge score that was 1.566 folds higher than that of participants who worked

in non-medical professions, p<0.001. Participants with a higher income had a 0.707-fold lower score compared to those with a monthly income lower than 500 JOD (p =0.005, Table 4).

DISCUSSION

Studies that evaluate the awareness, knowledge, and behavior of the Jordanian public regarding misuse and overuse of Proton Pump Inhibitors are scarce and they are still an unexplored

Table 3. Knowledge of participants regarding proton pump inhibitors (PPIs) use	
	Average score
Do you think that PPIs have side effects?	0.72/1
Yes ^a	
No	
Do you think that PPIs have Drug-drug interactions	0.56/1
Yes ^a	
No	
The correct duration for nonprescription PPIs use is	0.13/1
Two weeks or less ^a	
Less than one month	
Less than one year	
More than one year	
As needed regardless of duration	
I don’t know	
The best time to take PPIs	0.71/1
30 min before breakfast ^a	
30 min after meals	
At bedtime	
I don’t know	
Which one of the following is/are considered as S.E for PPIs used? (You can choose more than one) ^ε	0.64/4
Vitamin B12 ^a	
Calcium ^a	
Iron ^a	
Magnesium ^a	
Total score	2.8/8

^a: The correct answer; ^ε: All the answers are correct so the total score for this question is 4.



Table 4. Predictors of knowledge score using linear regression analysis

	Univariate linear regression			Multivariate linear regression		
	B	95% CI ^a	P	B	95% CI ^a	P
Age	-0.025	-0.041-0.009	0.002	-0.003	-0.024-0.019	0.821
Gender						
Female [€]						
Male	-0.158	-0.664 0.348	0.539	-0.122	-0.585-0.341	0.603
Social status						
Married [€]						
Widower	-0.444	-1.544-0.656	0.427	-0.269	-1.343-0.804	0.621
Divorced	-0.644	-2.346-1.058	0.456	-0.801	-2.347-0.745	0.308
Single	0.531	0.017-1.044	0.043	-0.135	-0.769-0.499	0.674
Education level						
Bachelor's degree or higher education [€]						
High school	-0.524	-1.197-0.148	0.126	-0.338	-0.993-0.316	0.309
Less than high school	-1.369	-3.067-0.329	0.113	-0.864	-2.495-0.767	0.298
Do you work in the medical field?						
No [€]						
Yes	1.581	1.14-2.017	< 0.001	1.566	1.085-2.048	< 0.001
Monthly income (Jordanian dinars, JOD)						
< 500 [€]						
> 500	-0.387	-0.861-0.087	0.109	-0.707	-1.199--0.216	0.005

€: Reference; ^a: Confidence interval; B: Unstandardized coefficient.

subject in Jordan. According to the study's findings, Jordan is a young country, which is confirmed by the literature, and by UNICEF's estimate that 63% of Jordanians are under 30.¹¹ The study's mean age was less than 40. Cardiovascular diseases and diabetes were the most common medical conditions among the Jordanian public, and this is supported in the literature.¹² Only one-third of the current study participants experienced a GI problem, but around half of them are using PPIs. So, this is considered an overutilization of PPIs. Prescription of PPIs without the proper justification or improper continuation of PPIs after hospital discharge are examples of overusing prescription PPIs.¹³ And this is clear in this study; from the weak knowledge score about the correct duration for PPI use. It should be noted that improper long-term PPI use may result in worse clinical outcomes.^{14,15} Long-term PPI therapy patients are more susceptible to drug bioavailability variations, vitamin B12 deficiencies, *Clostridium difficile* infections, community-acquired pneumonia, and fractures of the hip, wrist, and spine.¹⁶ In this study, most participants suffered from vitamin B12 deficiency. According to numerous studies, PPI use and costs have significantly increased globally during the past ten years,¹⁷ with the fact that PPI misuse could be practiced at any level of the health sector, starting from community pharmacies, outpatient clinics, emergency clinics, hospitals, or even the general population when used as OTC drugs.⁴ Based on a recent study, 86% of patients in the general medical ward of a tertiary Jordanian hospital who were prescribed PPIs did not have the proper indications.¹⁸ One study focused

on PPI abuse in Lebanon and discovered that only 9.2% of participants received the correct dosage of a PPI, while fewer than half received a PPI for the correct indication. Moreover, the surgery ward experienced more PPI abuse than the medical department did.¹⁹ In one study, hospitalized patients in the internal medicine department of a tertiary Greek hospital received PPIs, however, up to 81.2% of them experienced no indications.²⁰ In this study, the most frequent PPI used was esomeprazole, mostly after a physician's prescription. More than half of the participants were told the best time to take the PPIs by the pharmacist. So, the pharmacists in our community were not the first prescribers for PPIs, unlike a study in Saudi Arabia, which found that almost all community pharmacists prescribe anti-ulcer drugs for their patients. Most participants received PPI prescriptions for acute gastritis; among them, 32% of respondents had experienced PPI side effects. According to the study, there is a substantial link between reporting adverse events and the length of time spent working in a community pharmacy.²¹ Predictors for higher scores indicate being a worker in a medical field and, surprisingly, having a low income. This emphasizes the necessity for public education regarding the dissemination of erroneous and misleading information that is not backed up by scientific research. The findings of this study will be useful in directing public health policies and government initiatives toward greater awareness campaigns to fill knowledge gaps and dispel myths.



CONCLUSION

This is a web-based cross-sectional study that was conducted in Jordan through the distribution of a self-administered questionnaire. The aim of this study was to assess the awareness, knowledge, and behaviour of the Jordanian public regarding the misuse and overuse of proton pump inhibitors. Findings from this study demonstrated that the overall knowledge score for Jordanians was low, which indicates that the Jordanian public is unaware of the PPI correct use and possible side effects. Hence, with the dramatic increase in PPIs use, educational initiatives and programs are required to enhance public knowledge, particularly among those with non-medical educational backgrounds and monthly incomes above 500JD.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Methods in this research comply with international and national standards for the Declaration of Helsinki, so this study was approved by the Institutional Review Board (IRB) of Al-Ahliyya Amman University (AAU), Research Ethics Committee, with a reference number (IRB: AAU/2/13/2021-2022). Consent from participants was obtained through the web-based survey. After explaining the study nature to participants, the first question in this survey was to ask the participant whether they agreed to participate in this survey or not; If they responded no, they would be transferred to the submission page.

AUTHOR CONTRIBUTION STATEMENT

All the authors listed in this article have made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important

intellectual content; and final approval of the version to be published.

CONSENT FOR PUBLICATION

All authors confirm that the manuscript has been read and approved by all named authors. The order of authors listed in the manuscript has been approved by all named authors.

DATA ACCESS STATEMENT

The corresponding author has full access to the data underlying this article.

DATA AVAILABILITY STATEMENT

The data underlying this article will be shared on reasonable request to the corresponding author.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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References

1. Mat Saad AZ. Proton pump inhibitors: a survey of prescribing in an Irish general hospital. *Int J Clin Pract*. 2005;59(1):31-4. <https://doi.org/10.1111/j.1742-1241.2004.00298.x>
2. Shin JM, Kim N. Pharmacokinetics and pharmacodynamics of the proton pump inhibitors. *Journal of Neurogastroenterology and Motility*. 2013;19(1):25.
3. Eid SM, Boueiz A, Paranj S, et al. Patterns and predictors of proton pump inhibitor overuse among academic and non-academic hospitalists. *Internal Medicine*. 2010;49(23):2561-8. <https://doi.org/10.2169/internalmedicine.49.4064>
4. Savarino V, Marabotto E, Zentilin P, et al. Proton pump inhibitors: use and misuse in the clinical setting. Expert review of clinical pharmacology. 2018;11(11):1123-34. <https://doi.org/10.1080/17512433.2018.1531703>
5. Makunts T, Alpatty S, Lee KC, et al. Proton-pump inhibitor use is associated with a broad spectrum of neurological adverse events including impaired hearing, vision, and memory. *Scientific reports*. 2019;9(1):1-10. <https://doi.org/10.1038/s41598-019-53622-3>
6. Mazer-Amirshahi M. Rising rates of proton pump inhibitor prescribing in US emergency departments. *Am J Emerg Med*. 2014;32(6):618-22. <https://doi.org/10.1016/j.ajem.2014.03.019>
7. Simonso W. Implications of over-the-counter proton pump inhibitors for patient counseling by pharmacists. *Am J Ther*. 2013;20(6):676-84. <https://doi.org/10.1097/mjt.0b013e318217a5d1>
8. McCoul ED. Direct-To-Consumer Advertising of Over-the-Counter Sinonasal Remedies: A History of Mixed Messages. *Laryngoscope*. 2020;130(9):2114-19. <https://doi.org/10.1002/lary.28366>
9. Ladd AM. Potential costs of inappropriate use of proton pump inhibitors. *Am J Med Sci*. 2014;347(6):446-51. <https://doi.org/10.1097/maj.0b013e31829f87d5>



10. Raosoft I. Sample size calculator. Available from: <https://www.raosoft.com/samplesize>. 2004.
11. Youth. Unicef.org. Accessed March 2, 2022. Available at: <https://www.unicef.org/jordan/youth>
12. Mosleh SM, Almalik MM. Illness perception and adherence to healthy behaviour in Jordanian coronary heart disease patients. *European Journal of Cardiovascular Nursing*. 2016;15(4):223-30. <https://doi.org/10.1177/1474515114563885>
13. Heidelbaugh JJ, Kim AH, Chang R, et al. Overutilization of proton-pump inhibitors: what the clinician needs to know. *Therapeutic Advances in Gastroenterology*. 2012;5(4):219-32. <https://doi.org/10.1177/1756283x12437358>
14. Moriarty F, Cahir C, Bennett K, et al. Potentially inappropriate prescribing and its association with health outcomes in middle-aged people: a prospective cohort study in Ireland. *BMJ open*. 2017;7(10):e016562. <https://doi.org/10.1136/bmjopen-2017-016562>
15. Eusebi LH, Rabitti S, Artesiani ML, et al. Proton pump inhibitors: risks of long-term use. *Journal of gastroenterology and hepatology*. 2017;32(7):1295-302. <https://doi.org/10.1111/jgh.13737>
16. Nishtala PS, Soo L. Proton pump inhibitors utilisation in older people in New Zealand from 2005 to 2013. *Intern Med J*. 2015;45(6):624-9. <https://doi.org/10.1111/imj.12757>
17. Imhann F. Proton pump inhibitors affect the gut microbiome. *Gut*. 2016;65(5):740-8. <https://doi.org/10.1136/gutjnl-2015-310376>
18. Alqudah MA. Overuse of proton pump inhibitors for stress ulcer prophylaxis in Jordan. *Int J Clin Pharmacol Ther*. 2016;54(8):597-602. <https://doi.org/10.5414/cp202533>
19. Souaid CK. Relevance of proton pump inhibitors prescriptions in a tertiary care hospital in Lebanon. *Arab Journal of Gastroenterology*. 2020;21(3):194-8. <https://doi.org/10.1016/j.ajg.2020.07.008>
20. Ntaios G. Evaluation of use of proton pump inhibitors in Greece. *Eur J Intern Med*. 2009;20(2):171-3. <https://doi.org/10.1016/j.ejim.2007.10.020>
21. Alhossan A. Attitude and knowledge of Saudi community pharmacists towards use of proton pump inhibitors. *Saudi Pharm J*. 2019;27(2):225-8. <https://doi.org/10.1016/j.jsps.2018.11.002>