

1 **Impact of education workshop on improving pharmacy students' knowledge**  
2 **about *Helicobacter pylori* infection: A randomized controlled study**  
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17 **Running title:** Education workshop and H pylori  
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30 **Impact of education workshop on improving pharmacy students' knowledge**  
31 **about *Helicobacter pylori* infection: A randomized controlled study**

32 **Abstract**

33 **Rationale, aims, and objective:** Evidences show that the level of awareness about *H.pylori* is  
34 still low, and working on this issue is expected to be very impactful to improve infection rates  
35 and disease spread. This research aimed is to assess the level of knowledge and the degree of  
36 awareness among undergraduate pharmacy students in regard to *H pylori* diagnosis and  
37 management before and after delivering an educational pharmacy intervention.

38 **Methods:** This is a randomized controlled study that was conducted in May 2020. During the  
39 study period, 72 pharmacy students were invited to attend a workshop about *H pylori*  
40 management and diagnosis. Participants' knowledge and general awareness about *H pylori*  
41 infection was evaluated before and after the workshop (25-minute educational lecture for the  
42 intervention group and educational pamphlet for the control group). At the end of the workshop  
43 participants' ability to distinguish and correctly diagnose virtual cases was tested.

44 **Results:** Most of the participating students (n=58, 80.6%) haven't been involved in similar  
45 workshops previously. Following education workshop, students in the intervention group showed  
46 a significant improvement in their knowledge score (from 9.2 (SD=1.9) pre-workshop to 10.4  
47 (SD= 1.9) post-workshop, (P-value =0.001) while students in the control group didn't (pre-  
48 workshop knowledge score of 9.1 (SD= 2.2) and post-workshop score of 9.4 (SD= 1.6), (P-value  
49 =0.324).

50 Also, students in the intervention group produced better results than the control group in  
51 distinguishing and diagnosing provided *H pylori* cases in the workshop with higher score of 2.2  
52 for the intervention group compared to 1.6 for the control group (P-value= 0.026).

53 **Conclusion:** Education workshops about *H pylori* infection are needed to build a strong base of  
54 qualified healthcare providers as an outstanding output of our higher educational programs,  
55 which in turn improves the quality and reduces the burden on healthcare systems.

56 **Keywords:** *H pylori*; educational intervention; pharmacy student; knowledge; diagnosis

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62 **What is already known about this topic?**

- 63 • With high prevalence and epidemiology rates, *H pylori* is considered to be a serious  
64 infection worldwide.  
65 • Continuous education for pharmacists or preparing pharmacy students to deal with such  
66 problems via early referral, patient consultation and correct management after the  
67 patient's visit to the physician can be the key to reduce the risk of *H pylori* infection.  
68

69 **What does this study add?**

- 70  
71 • This is considered to be one of the first studies assessing pharmacists' and undergraduate  
72 pharmacy students' knowledge, awareness and perceptions regarding H pylori  
73 management and diagnosis specifically before and after receiving an educational  
74 workshop.  
75 • The study results support the proposed hypothesis in this research where we suggested  
76 that implicating well designed pharmacy education programs regarding H pylori infection  
77 management and diagnosis will have a positive impact on pharmacy student's  
78 knowledge, awareness, ability to detect possible cases or provide early diagnosis

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87        **1. Introduction**

88        With high prevalence and epidemiology rates, *Helicobacter Pylori* (*H pylori*) is considered to be  
89        a serious infection worldwide [1]. Multiple risk factors can increase infection risk and  
90        compromise the patient status, such as: increased acid production, use of certain pharmaceutical  
91        agents, stress factors, toxins from a dietary source, polluted water intake and improperly  
92        sanitized food sources [2]. Directly or indirectly, this bacterium can be the cause for the  
93        development of other diseases including gastric cancer and other inflammatory diseases [3].

94        Screening and testing for this infection involves many invasive and non-invasive techniques,  
95        utilizing different biological samples that vary from stool, blood serum antigens and antibodies,  
96        and breath-based tests or more advanced methods via polymerase chain reaction technology  
97        (PCR) [4]. Evidences show that the level of awareness about *H.pylori* is still low [5], and  
98        working on this issue is expected to be very impactful to improve infection rates and disease  
99        spread. Being one of the most accessible healthcare professionals, pharmacists are expected to  
100        have a very important role in this field, and spreading awareness is a vital goal to be achieved.  
101        [6].

102        Continuous education for pharmacists or preparing pharmacy students to deal with such  
103        problems via early referral, patient consultation and correct management after the patient's visit  
104        to the physician can be the key to reduce the risk of *H pylori* infection. New and specially  
105        designed teaching programs, workshops or simulation cases are all methods of teaching expected  
106        to have a positive impact on the management and diagnosis of topics similar to *H pylori*  
107        infection, which produces better educational outcomes and sharper acquired skills [7].

108 Delivering point of care interventions like reviewing appropriateness of choice of medications,  
109 directed therapy based on microscopy and susceptibility test results in cases like infectious  
110 diseases can be a difference maker in disease progression and early diagnosis [8]. The need for  
111 quality educational activities to push for more high-performance personnel as products of  
112 educational programs can satisfy this need and as a result improve the ability of healthcare  
113 systems to combat such problems both on a local and universal level. In this study we are  
114 attempting to assess the impact of specially designed educational workshops on pharmacy  
115 students' knowledge about *H pylori* infection diagnosis and management.

## 116 **2. Methods**

### 117 **2.1 Study design, setting and study subjects**

118 This study adopted a randomized controlled study design that was conducted in the faculty of  
119 pharmacy at Applied Science Private University (ASU) in Amman-Jordan. Data collection took  
120 place in May 2020. During the study period, a convenience sample of pharmacy students from  
121 the third, fourth and fifth year was invited to participate in this study to assess that impact of  
122 education workshop on their knowledge about *H pylori* infection management and diagnosis.

### 123 **2.2 Sample size calculation**

124 The sample size was calculated based on the results of a previous study which evaluated the  
125 impact of a learning program in improving nurses' skills in the identification and classification of  
126 PUD cases[9]. In that study, the pooled standard deviations for the total skill scores for both the  
127 intervention and the control group was 1.51. Setting alpha at 0.05, the power of 80%, and using  
128 the following equation:

129  $N = 2 \sigma^2 (Z_{\text{critical}} + Z_{\text{power}})^2 / D^2$

130 Where,

131  $\sigma$  is the pooled standard deviation for both groups.

132 Z critical value is equal to 1.96 for the 0.05 significance level.

133 Z power value is equal to 0.842 for the 80% statistical power.

134 D is the minimum expected difference between the two means which was set as 1.

135 Based on the above equation, the minimum required sample size to obtain a significant  
136 difference was calculated as 36 subjects per group.

### 137 **2.3 Ethical considerations**

138 The study protocol was approved by the Ethics Committee at the ASU (Approval number 2020-  
139 PHA-10). The study was conducted following the ethical standards outlined in the World  
140 Medical Association Declaration of Helsinki guideline [10]. Students were informed that their  
141 participation in the study is voluntary and that their responses will be kept confidential and  
142 analyzed only as part of a cohort. Written informed consents were obtained from all participants  
143 before the interview.

### 144 **2.4 Study survey**

145 The structured questionnaire was based on literature reviews [11-13]. The questionnaire was  
146 validated by senior academicians and researchers, with long expertise in this research area. The  
147 survey was divided into three main parts: (i) questions to determine participants' demographic  
148 characteristics, (ii) questions to assess participants' general knowledge and awareness about  
149 *H.pylori*, and (iii) four clinical cases that represent actual *H pylori* cases and closely related

150 (non-*H pylori*) cases to assess the students' ability to differentiate and point out actual reported *H*  
151 *pylori* cases as a measure of the effectiveness of the workshop.

152 For the knowledge questions, pharmacy students were awarded one grade if their answers were  
153 correct and zero grade if the answer was false. Finally, a total knowledge score out of 13 was  
154 calculated for each pharmacy student.

## 155 **2.5 Data collection prior to the training workshop**

156 Students of the third, fourth and fifth year were invited to an educational workshop held in the at  
157 the faculty of pharmacy, aimed to increase their knowledge, and awareness of disease signs,  
158 symptoms and diagnosis methods. Online invitations were sent to students via social media  
159 websites in which participants had to state their name to be registered as a participant and be  
160 informed about the details of participation and the constituents of the workshop.

161 All the 72 registered students were invited to participate in a one-hour simulated training  
162 workshop, they were asked to take their seats, where they found pre-workshop data collection  
163 forms placed on the front of each seat. The pre-workshop data collection form (required 15  
164 minutes) consisted of 1) Consent form, where students read the objective of the study and then  
165 provide their signature as consent to participate in this study, and 2) a section about  
166 demographics and answered general questions about *H pylori*, 3) also, students answered  
167 multiple close-ended questions to assess their general awareness and knowledge about *H pylori*  
168 diagnosis and management.

169 Following the baseline data collection, participants were divided into two groups using  
170 randomization table generated using the Social Science for Statistical Package software (SPSS)

171 version 24 (SPSS Inc., Chicago, IL, USA) which resulted in 36 students assigned to the control  
172 group and 36 students assigned to the control group.

### 173 **2.6 The education workshop**

174 The control group students received an informative brochure to read about *H pylori*  
175 epidemiology, signs and symptoms and diagnosis methods, followed by a period for exchanging  
176 any questions that the students might have regarding the contents of the brochure. While the  
177 intervention group firstly received a 25-minutes detailed educational workshop that involve a  
178 lecture covers *H pylori* epidemiology and resistance trends, complications and related  
179 comorbidities, old and current diagnostic technologies utilized in practice, pharmaco-economic  
180 assessment of different treatment regimens prescribed. Secondly, simulation training took part on  
181 how to distinguish and diagnose *H pylori* infection which was presented to the students by the  
182 main researcher in this study and the simulator.

### 183 **2.7 Data collection post the simulated training workshop**

184 After simulation training is done, all students were proceeding to complete the remaining parts of  
185 the survey which required 20-minutes which included assessment of students' knowledge about  
186 *H pylori* diagnosis and management for the second time. Also, following these steps the students  
187 completed a form in which they were asked to distinguish between four different clinical cases.  
188 Three cases represented an actual *H pylori* cases and the other fourth case represented a closely  
189 related non-*H pylori* case to assess the impact and effectiveness of the educational intervention  
190 on their ability to diagnose *H pylori*.

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## 192 **2.8 Statistical analysis**

193 Data were analyzed using statistical package for social science (SPSS) version 22 (SPSS Inc.,  
194 Chicago, IL, USA). The descriptive analysis was done using mean and standard deviation (SD)  
195 for continuous variables and frequency (percentage) for categorical variables.

196 To ascertain whether the educational intervention has an impact on students' knowledge about *H*  
197 *pylori* diagnosis and management for both the control and intervention groups, Wilcoxon sign  
198 rank test was performed to assess the difference in the pre and post workshop knowledge score  
199 for each group. Group differences between control and intervention groups were conducted using  
200 Mann Whitney U test. For all statistical analysis, all tests were two-tailed and a P-value of less  
201 than 0.05 was considered statistically significant.

## 202 **3. Results**

### 203 **3.1 Evaluation of demographic characteristics of participating students**

204 In this study 72 pharmacy students volunteered to participate of which 57 students (79.2%) were  
205 females and 15 were males (20.8%). The mean age of students was 22 years (SD=1.75). Students  
206 demonstrated different settings of social living, where 27.8% of the (n=20) lived alone possibly  
207 because of them being students from abroad. Forty-seven students (65.3%) lived with their  
208 families and only five of them (6.9%) shared a home with their colleagues. Assessment of  
209 dietary habits followed by student showed that most of the students (n=48, 66.7%) had a diet  
210 mixed of home cooked and fast food, with only 4.2% of them (n=3) depending solely on fast  
211 food and 29.2% (n=21) eating only home cooked meals. **Table 1** shows some demographic  
212 characteristics of the study sample.

213 In this study most of the students have heard of *H pylori* before taking the workshop (n= 66,  
214 91.7%) and the remaining 8.3% (n= 6) of students have never heard of it before. The majority of  
215 participants haven't been involved in any similar workshops that discusses *H pylori* infection  
216 (n=58, 80.6%) while the other 19.4% (n=14) took previous workshops about this topic (**Figure**  
217 **1**).

### 218 **3.2 Baseline assessment of pharmacy student knowledge and awareness about *H pylori*** 219 **management and diagnosis.**

220 After evaluating students' knowledge and awareness about *H pylori* (**Table 2**), almost half of the  
221 students (n=34, 47.2%) realized that the chance of *H pylori* prevalence increases with time in our  
222 community while the other half said otherwise. The majority of students knew that an infection  
223 of *H pylori* can occur at any age (n=64, 88.9%). When asked if there are certain food types  
224 associated with getting an infection, 68.1% (n=49) answered correctly and 31.4% (n=23) didn't.  
225 When asked about the relationship between *H pylori* on one hand and good hygienic practice and  
226 socioeconomic status on the other hand, 79.2% (n=57) answered correctly and 20.8% (n=15)  
227 failed to do the same. The students had almost split answers when asked if *H pylori* can be  
228 contracted via different routes with 48.6% (n=35) agreeing with this statement, and 51.4%  
229 (n=37) disagreeing wrongfully.

230 Fifty-six of the students (77.8%) knew that there are more than one treatment regimen for *H*  
231 *pylori*, and 64.0% (n=46) knew that treatment regimen can last for more than 14 days. The vast  
232 majority of the students recognized some of the possible symptoms of *H pylori* (n=66, 91.7%).  
233 Twenty-six (36.1%) students believed that physicians only depend on reported symptoms from  
234 patients to diagnose them, where 46 students (63.9%) believed the opposite.

235 Almost two-thirds of the sample believed that once the patient is treated, the infection can't  
236 reoccur and that primary lab tests can be confirmed by other blood based (serum) tests (n=52,  
237 72.2%) and (n=51, 70.85), respectively. Most of the students knew that samples other than stool  
238 can be utilized for screening (n=44, 61.1%) as shown in **Table 2**.

### 239 **3.3 Impact of the educational workshop in improving pharmacy student awareness and** 240 **knowledge.**

241 When comparing the overall knowledge score before and after the workshop for both the control  
242 and intervention groups (**Figure 2**), students in the intervention group showed a significant  
243 improvement in their knowledge score (from 9.2 (SD=1.9) pre-workshop to 10.4 (SD= 1.9) post-  
244 workshop, (P-value =0.001) while students in the control group didn't (pre-workshop knowledge  
245 score of 9.1 (SD= 2.2) and post-workshop score of 9.4 (SD= 1.6), (P-value =0.324).

246 When evaluating the percent improvement in knowledge score between both groups, students in  
247 the intervention group showed improvement in knowledge score percentage (16.9%) slightly  
248 more than those in the control group (12.3%), but without a significant difference between them  
249 (P-value= 0.074) as shown in **Figure 3**.

### 250 **3.4 Impact of the educational workshop in improving pharmacy student ability to diagnose** 251 **several cases about *H. pylori*.**

252 Towards the end of the workshop students in both groups were presented with four cases that  
253 represent actual cases of *H pylori* and closely non-related ones for them to distinguish between  
254 cases and diagnose more accurately. Students in the intervention group were able to diagnose 3  
255 or more cases correctly better than those in the control group. Also, students in the intervention  
256 group scored lower percentages in regard to getting all cases wrong, with only (2.8%) in the  
257 intervention group compared to (13.9%) in the control group.

258 Overall, it seems that receiving an in-depth educational lecture helped students more in being  
259 able to distinguish between actual *H pylori* cases and closely non-related ones, than with an  
260 educational pamphlet alone as presented in **Figure 4**.

261 Finally, students gathered a higher score in the total number of correctly diagnosed cases in the  
262 intervention group with a score 2.2, significantly higher than their peers in the control group with  
263 a score of 1.6 with a P-value= 0.026 as shown in **Figure 5**.

264

#### 265 **4. Discussion**

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267 There are many studies that addressed the topic of *H pylori* in areas which focused on new ways  
268 to confirm positive diagnosis or looked deeply into trends of disease spread and prevalence  
269 among smaller communities and all the way to a worldwide level [14-16]. However, up to our  
270 knowledge, this is considered to be one of the first studies assessing pharmacists' and  
271 undergraduate pharmacy students' knowledge, awareness and perceptions regarding *H pylori*  
272 management and diagnosis specifically before and after receiving an educational workshop.

273 Putting out more qualified and up to par pharmacists as part of the healthcare provider's team is a  
274 goal that every entity in the world aims to concur. Achieving this goal means better health services  
275 for everyone, and this can only be done by the continuous development of educational programs and  
276 the ingenuity of ways to deliver knowledge and information to students.

277 In this study we took the topic of *H pylori* management and diagnosis; we attempted to utilize it  
278 as a model for similar topics to be covered within curriculum and designed different educational  
279 scenarios to assess the impact of such activity and how much difference it can make in the  
280 quality of the produced educational outcome for pharmacy students.

281 Although a small percentage of the students reported to have never heard of this topic before, the  
282 majority haven't been involved in any similar workshops that discuss *H pylori* infection. Around  
283 58% of participants were knowledgeable about the causative factors of *H pylori* infection  
284 compared to similar studies where only 41.5% of healthcare providers were knowledgeable in  
285 this regard [17]. Student's awareness about food involvement as a consumed carrier for infection  
286 was good, as 68% of them were certain about the role of certain food types in association with *H*  
287 *pylori* infection, which is confirmed in a related study [18]. [17][17][17]<sup>1717</sup> Most of the  
288 participants knew that *H pylori* infection can occur at any age (89%), and that it increases with  
289 time which is supports the results of Hussen et.al [19]. Students in intervention and control  
290 groups (72.2%) had realized the association between the chance of developing an infection with  
291 *H pylori* and the socioeconomic status of individuals, which reaffirms the findings of similar  
292 studies [20, 21]. Up to their knowledge most of the participants think that they are free of any *H*  
293 *pylori* infection. Almost all of the students (98.6%) agreed that if they attended courses or  
294 workshops dedicated to topics like *H.pylori*, they will be more able to manage these cases  
295 properly and believe that they have an important role as future pharmacists in the early reporting  
296 and referral of such cases, which complies with the educational outcomes of studies with  
297 specially designed educational programs versus traditional programs [22].

298 The educational workshop for the intervention group seemed to improve the level of awareness  
299 and knowledge about *H pylori* management and diagnosis with the overall knowledge score and  
300 percentage increased after attending the workshop for this study with 16.9%. This highlights the  
301 importance and apparent impact of such activities outside of the traditional educational setting  
302 similar to what was reported by several other studies [23, 24]. The results of this research  
303 amplify the importance and need of specially designed, more focused and reality simulating

304 educational activities like workshops or other ventures to be utilized and implicated within the  
305 high number of courses that students take before graduating.

306 The study results support the proposed hypothesis in this research where we suggested that  
307 implicating well designed pharmacy education programs regarding *H pylori* infection  
308 management and diagnosis will have a positive impact on pharmacy student's knowledge,  
309 awareness, ability to detect possible cases or provide early diagnosis. Findings of this study  
310 supports motivation theories that depends on supplying students with basic and psychological  
311 needs, like: security, safety, prestige and feeling of accomplishment (Maslow's Hierarchy of  
312 Needs) in order to reach self- fulfillment needs such as achieving full potential and involving  
313 creative activities (interactive workshops) [25].

314 If these educational activities are implicated on a broader level and if they take a part in each  
315 course listed in students' study plan, there could be a huge impact on how students can address  
316 similar issues upon the start of their practice in field. One of the biggest advantages provided  
317 from this type of educational intervention is the ability to imagine possible scenarios in student's  
318 minds, which improves the management of cases from previous experiences ending with a better  
319 outcome and more beneficial interaction between patients and pharmacists.

320 Another impact that stands out from this experience, is the ability of these type of educational  
321 programs to cover topics that wasn't necessarily covered thoroughly enough or wasn't planned  
322 for by faculty members and educators for reasons like time limits, concise environments or  
323 shortages of resources. This gives students and educators a greater opportunity to widen their  
324 horizons and may prepare educational environments where students can be creative and

325 innovative and not be worried about grades but only focus on gaining knowledge and be more  
326 informed.

327 This study had some limitations, as the study sample was collected from the faculty of pharmacy  
328 in the ASU and if other faculties in the country were involved, more reflective results may have  
329 been produced. Also, the impact of the education workshop was assessed only immediately after  
330 the workshop.

331 Future research involving specially designed educational activities needs to be promoted more to  
332 extract ideas, innovations, ways to improve educational experiences and increase our  
333 understanding about the current quality of delivered educational programs and what needs to be  
334 improved depending on priorities and in a way that goes hand in hand with official regulatory  
335 bodies responsible for education on a country level.

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#### 340 341 **6. Conflict of interest**

342  
343 The Authors declare that there is no conflict of interest.

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444 **Figures legends**

445 Figure 1. Students previous awareness about *H pylori*, (n= 72)

446 Figure 2. Differences between pharmacy students' knowledge scores before and post the  
447 workshop for the control group (n= 36, P-value = 0.324) and for the intervention group (n= 36,  
448 P-value= 0.001) using Wilcoxon sign rank test

449  
450 Figure 3. Difference in the improvement in knowledge score percentage between the control  
451 group (n= 36) and the intervention group (n= 36), (P-value= 0.074 using Mann-Whitney U test)  
452

453 Figure 4. Percentages of correct cases diagnosed by students for both the control group (n= 36)  
454 and the intervention group (n= 36)

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456 Figure 5. Difference in the improvement in the number of correctly diagnosed cases between the  
457 control group (n= 36) and the intervention group (n= 36), (P-value= 0.026 using Mann-Whitney  
458 U test)

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