

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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**Impact of education workshop on improving pharmacy students' knowledge
about *Helicobacter pylori* infection: A randomized controlled study**

Abstract

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

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

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

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

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

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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1. Introduction

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

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

Continuous education for pharmacists or preparing pharmacy students to deal with such problems via early referral, patient consultation and correct management after the patient's visit to the physician can be the key to reduce the risk of *H pylori* infection. New and specially designed teaching programs, workshops or simulation cases are all methods of teaching expected to have a positive impact on the management and diagnosis of topics similar to *H pylori* 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 σ 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, pharmacoeconomic
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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2.8 Statistical analysis

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

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

3. Results

3.1 Evaluation of demographic characteristics of participating students

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

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

3.3 Impact of the educational workshop in improving pharmacy student awareness and knowledge.

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

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

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

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

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

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

4. Discussion

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

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

In this study we took the topic of *H pylori* management and diagnosis; we attempted to utilize it as a model for similar topics to be covered within curriculum and designed different educational scenarios to assess the impact of such activity and how much difference it can make in the 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]¹⁷¹⁷ 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**

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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

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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)

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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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