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Effect of mobile based educational program on mother's knowledge and practice regarding care of children with helicobacter pylori infection

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Abstract

Background: One of the most common human pathogens is the spiral and microaerophilic bacteria *H. pylori*, which also causes stomach adenocarcinoma, peptic ulcers, chronic gastritis, and mucosa-associated lymphoid tissue lymphoma in children. Mobile education based on smartphones is applied in many different areas. Due to its great portability, learning space is increased and learners can work at their own pace. Simulation learning is also possible. Information could be replayed.

Objective: This study sought to assess the effect of a mobile-based teaching program on mothers' knowledge and reported practice regarding care of children with helicobacter pylori infection.

Methods: The current study utilized a quasi-experimental design. The current investigation has been carried out in the outpatient pediatric clinics of Benha University Hospital as well as Benha Teaching Hospital. From the abovementioned setting, a non-probability purposeful sample of 100 women and their children was selected. Three tools have been utilized: (1) a structured interview questionnaire sheet; (2) a self-reported practice questionnaire sheet; and (3) a medication adherence scale.

Results: Prior to the implementation of a mobile-based educational program, the majority of the examined mothers (89%) had an unsatisfactory level of knowledge; however, after the program, the vast majority (98%) had a satisfactory level of knowledge. The majority of the studied mothers (96%) had an inadequate level of practice in pre-program implementation. In contrast, 93% of them had an adequate level of practice post-program.

Conclusion: Improvements in mothers' knowledge and practices regarding the care of their children with Helicobacter pylori infections were more effectively with mobile-based education. Again, there had been a highly statistically significant positive link between mothers' overall knowledge level, overall practice level, and overall medication adherence level before and after the mobile-based program's implementation. For mothers of children with Helicobacter pylori infection, healthcare practitioners could employ mobile-based educational methods to promote their children's health.

Keywords: Determine mobile based education, mother knowledge and practice, children, helicobacter pylori

Introduction

One of the most common human pathogens is the spiral, microaerophilic bacteria *H. pylori*, which also causes stomach adenocarcinoma, peptic ulcers, chronic gastritis, and MALT lymphoma in both children as well as in adults. The key factors influencing the frequency of *H. pylori* infections are socioeconomic position and living circumstances. This infection is typically acquired throughout childhood and can last a lifetime if left untreated (Crowded and poor hygiene). The continuation of bacterial exposure causes gastritis and other serious consequences [1].

The cause of chronic gastritis has been linked to Helicobacter pylori. Nevertheless, extra-digestive impacts on growth indices in young children have been documented. Childhood growth impairment and *H. pylori* infection have been linked in a variety of studies. One mechanism is that Helicobacter pylori suppresses stomach acid secretion. That may lead to infection with enteropathogens and diarrhea, nutrient malabsorption, decreased food intake due to dyspepsia, and iron-deficiency anemia (IDA) [2].

Roughly 50% of the population is afflicted with Helicobacter pylori. Children around the world are known to be affected, and the incidence varies by country. It can vary geographically within a country and is less in high-income nations (34.7%) than in low-income and middle-income nations (50.8%). The infection is most commonly acquired during childhood and is more frequent in developing countries, where around 70% of children remain afflicted until the age of 15, but it is disappearing in industrialized countries [3].

Person-to-person transmission of *H. pylori* infection between family members is common, with mother-to-child transmission becoming the most common and oral-oral and oral-faecal transmission routes becoming the most significant. Because the bacterium can persist for a long time in a viable condition in contaminated water, it could also be a cause of infection. Several link diet and socioeconomic factors to *H. pylori* infection, raising the possibility that these factors play a significant role in the transmission of the illness through foods like milk, meat, and vegetables. Another potential cause of infection is saliva [4].

Eradication treatment should be administered to children who have a proven *H. pylori* infection and peptic ulcer. Antibiotics and a proton pump inhibitor (PPI) are used in eradication treatment to improve the antimicrobial efficacy. Given that longer courses are more effective, the recommended length of therapy is 14 days. It is crucial to select the appropriate regimen. Over time, eradication success rates have decreased and frequently fall short of the required 90% threshold. Therapy failure may happen as a result of poor compliance, but rising antibiotic resistance (especially to clarithromycin) is a key motivator. Patients and relatives must receive counselling on the significance of strict adherence to enhance the eradication chances and prevent resistance development [5].

There are several factors can lead to poor medication adherence among *H. pylori*-infected pediatric patients such as; poor socioeconomic status, age, educational and awareness level of parent, complexity and duration of therapeutic regimen, and improper counseling by health care providers. Nursing staff considered the most responsible personnel for providing health education for infected child and his parent regarding good personal hygiene, proper sanitation, a decrease in the number of close contacts, and importance of medication adherence to improve patients' outcomes and reduce *H. pylori* intrafamilial transmission [6].

A smartphone can be used anywhere, at any time. It is a mobile device that is highly portable and available. People may now more quickly and easily look for and give information on cultural activities, educational resources, economic activities, and social communication due to smartphones. Mobile learning via smartphones is applied in many different areas. Educational space is enlarged due to its high portability; simulation education is also possible, utilizing a user's location-based data; and self-directed learning could be accomplished, in which learners could practice specific skills and knowledge repeatedly without spatial restraints. Data could be replayed, and learners could work through it at their own pace [7].

Significance of the study

One of the most prevalent chronic infections, Helicobacter pylori, affects roughly 50% of people globally. Such an infection is most commonly acquired throughout childhood, particularly in developing nations. The frequency of *H. pylori* differs greatly between nations; in developing countries, almost half of children are afflicted by the age of ten. Children with symptoms attending the gastroenterology unit's outpatient clinics in Egypt had a high frequency of *H. pylori* infections (64.6%) [2].

Roughly half of the globe's population is infected with *H. pylori*, a major gastric pathogen that can lead to a number of disorders of the stomach, such as chronic gastritis, gastric atrophy, gastric MALT lymphoma, peptic and duodenal ulcerations, as well as gastric adenocarcinoma. *H. pylori* infections are more common in early childhood and are transmitted intrafamilially via both the fecal-oral and oral-oral pathways [8]. There are several factors can lead to poor medication adherence among *H. pylori*-infected pediatric patients such as; poor socioeconomic status, age, educational and awareness level of parent, complexity and duration of therapeutic regimen, and improper counseling

by health care providers [6]. Therefore providing health education for infected child and his mother regarding good personal hygiene, proper sanitation, a decrease in the number of close contacts, and importance of medication adherence is very important to improve pediatric patients' outcomes.

Smartphone-based learning may offer a self-directed educational environment where people may access information and practice skills frequently without being limited by time or space. Mobile education based on smartphones is applied in many different areas. Learners may work at their own pace and may replay information. Because of its high portability, the learning space is increased. By employing a user's location-based information, simulation learning is also likely to occur [9]. So, this study aims to improve mother's performance regarding care of children with helicobacter pylori infection through design and implement a mobile based educational program for mothers based on their actual needs.

Aim of the study

The goal of this research was to enhance mothers' knowledge and practice of caring for children with helicobacter pylori infection. through the following objectives:

1-Assess mothers' knowledge level regarding care of children affected with helicobacter pylori infection.

2-Assess mothers' reported practice level regarding care of children affected with helicobacter pylori infection.

3-Assess mothers' medication adherence level of children affected with helicobacter pylori infection.

4-Design and implement an educational program for mothers using mobile phones that is based on their real requirements.

5-Assess the impact of a mobile-based educational program on mothers' knowledge and practice regarding care of children with helicobacter pylori infection.

Research hypothesis

1-Mothers'knowledge regarding care of children with helicobacter pylori infection will be increased after implanting mobile based educational program.

2-Mothers' practice regarding care of children affected with helicobacter pylori infection will be improved after implanting mobile based educational program.

3-Mothers' medication adherence level regarding helicobacter pylori infection will be improved after implanting mobile based educational program.

4-There has been a positive association among mothers' total knowledge, practice, and medication adherence level.

Subject and Methods
I-Technical design:

The study's technical design included the following elements: study design, setting, participants, and data collection tools.

Research design:

A quasi-experimental design has been used in this study.

Research Settings:

The present research has been carried out at the pediatric

outpatient clinics at the Benha Teaching Hospital and Benha University Hospital, both of which are connected to the Egyptian Ministry of Health and Population. Both settings' outpatient pediatric clinics were on the ground floor and had two rooms. Both outpatient pediatric clinics provide health care for children.

Subjects
Two types of samples were used as subjects.

Type (1): Following fulfilment of the following inclusion criteria, a nonprobability purposive sampling of 100 moms has been selected from the aforementioned settings who were willing to take part in the research.

Inclusion criteria:
1. Responsible for providing routine of care for their children affected with *H. pylori* infection.
2. Mothers who have smart phone and able to use WhatsApp application.
3. Mothers who are able to read and write.

Exclusion criteria
1-Mothers having serious psychological problems or mental disease.

Type (2): A purposive sample of 100 children suffering from *H. pylori* infection by positive stool antigen test

Tools of data collection
The following tools were used to collect data: Tool (I): A sheet for a structured interview questionnaire:
It has been created by researchers based on [2, 10] to assess mothers' knowledge regarding care of children with *H. pylori* infection. It has three main parts and has been written in Arabic.

Part (1): Characteristics of the mothers under study, such as age, educational level, occupation and sources of information about *H. pylori* infection.

Part (2): Housing characteristics: residence, availability of pure water supply, crowding index and eating from street vendors.

Part (3): Characteristics of the children under study, such as age, sex, educational level, previous hospitalization related to *H. pylori* infection and present complain.

Part (4): Mothers' knowledge about *H. pylori* infection
The tool had (6) open-ended questions and (9) multiple-choice questions related to definition of stomach, function of stomach, definition of *H. pylori* infection, mode of transmission, high-risk groups, manifestation of *H. pylori* infection, screening tests for diagnosis of *H. pylori* infection, management of *H. pylori* infection, definition of probiotics, type of food help in management of *H. pylori* infection, type of food that irritate the stomach wall, complication *H. pylori* infection, definition of intrafamilial transmission, prevention methods from *H. pylori* infection and home care for child with *H. pylori* infection.

Total scoring system
The study's mothers' answers have been compared to a model key answer, which was rated as follows: complete correct answers received a score of 2, incomplete correct answers received a score of 1, and wrong or unknown answers received a score of 0. The range of total knowledge scores was 0 to 30. In this regard, mothers' knowledge levels were classified as satisfactory (60-100%; ranged from 18-30 points) or unsatisfactory (< 60%; ranged from 0 < 18 points).

Tool II: Self-reported practice questionnaire sheet
It was adapted from Lynn [11] and Nguyen *et al*. [12] to assess mothers' reported practice level regarding care of children with *H. pylori* infection, modified by the researchers to suit the nature of the study. It included 20 steps grouped under five main parts as practice related to hand washing (3 steps), practice related child hygiene (4 steps), house hygiene practices (2 steps), food and water supply related practices (5 steps) and medication administration related practices (6 steps).

Total scoring system
The study's moms' answers have been compared to a model key answer that was graded as done had a (1) score and not done had (0) score. The total practice scores varied from 0 to 20 points. In this regard, the level of reported practice by mothers was classified as adequate (70% to 100%) and ranged from 14-20 points, while inadequate (< 70%), ranged from 0 < 14 points.

Tool III: Medication adherence scale
It was adopted from Culig and Leppée [13] to assess the level of mothers' adherence to helicobacter pylori eradication therapy, it consisted of 10 questions answered by yes or no.

Total scoring system
Total medication adherence scale scores ranged from 0-10. As a result, the level of medication adherence has been classified as poor (< 50%) with a range of 0 < 5 points, average (50% to <70%) with a range of 5 < 7 points, and good (70-100%) with a range of 7-10 points.

II-Operational design
The preparatory phase, content validity of the tools used, their reliability, pilot research, and field research were all included in the operational design

Preparatory phase
This phase involved studying relevant literature and theoretical knowledge of different study aspects; employing books, papers, the internet, periodicals, and journals at the local and international levels to construct the study instruments and become familiar with the different study elements of the study difficulties.

Designing mobile based educational program:
The mobile based educational program
(WhatsApp group) were developed by the researchers and aimed to improve mothers' performance level regarding care of children affected with helicobacter pylori infection**.** Designing the program had taken period extended from the

beginning to the end of December 2020. The researcher designed program based on the actual need assessment of the study sample.

Content validity
Tools for data gathering have been translated into Arabic and tested for content validity by three experts (two in pediatric nursing and the other in the area of medical-surgical nursing specialization from Benha University's faculty of nursing) to assess the tools' clarity, comprehensiveness, significance, accuracy, and simplicity. All of their suggestions have been taken into account, and some have been revised to create the final version of the tools. From their perspective as experts, the tools have been thought to be reliable.

Reliability
The Cronbach's alpha coefficient test has been used to determine the tools' reliability. This turned to be ($\alpha = 0.92$) for a structured interview questionnaire sheet, ($\alpha = 0.80$) for mothers self-reported practice and ($\alpha = 0.89$) for medication adherence scale. This indicates the favorable internal consistency and high reliability for the study tools.

Ethical considerations
The Ethics Committee of Benha University's Faculty of Nursing approved the study. The researchers clarified the aim of the study and the expected outcomes to all the studied mothers during the initial interview. Verbal approval was requested to participate in the current study. The studied mothers were assured that all information would be confidential. Additionally, mothers were allowed to leave the study at any moment and without explanation.

Pilot study
A pilot study has been carried out to assess the clarity and application of the study tools, as well as to determine the time required for every instrument. It has been conducted on 10% of the total individuals, (10) children who had H pyloric infections, and (10) moms who were omitted from the current research to prevent sampling bias and contamination. The last form has been established after modifications have been made in light of the results of the pilot study analysis. From the start to the end of January 2021, this phase lasted one month.

Field of Work
The mobile based educational program was implemented to achieve the aim of the current study by these phases, assessment, planning, implementation and evaluation phase. The actual work was carried out over period 6 months from the earliest starting point of February 2021 to the end of July 2021. The actual field work was divided into four phases.

Assessment phase
Mothers were interviewed during the evaluation stage to get baseline data. It took roughly eight weeks, and the researchers were present four days a week (Saturday, Monday, Tuesday, and Thursday) alternately in every study setting from 9.00 AM to extended till 12.30 AM. The average number of interviewed mothers was 3-4 mothers per day. The researchers welcomed every mother, discussed

the goal, length, and activities of the research, and obtained written consent at the start of the interview. The data of children affected by H pyloric infection was collected by the researcher and each child required about 15 minutes. The researchers offered the mothers studied a questionnaire to complete in order to evaluate their knowledge, stated practice, and medication compliance, which took 30 minutes.

Planning phase
The mobile-based educational programme has been built by the researchers relying on baseline data from the evaluation stage and a relevant literature review, as evidenced by mothers' level of comprehension in simple Arabic. Various teaching techniques have been employed, including modified lectures, brainstorming sessions, demonstrations, and group discussions. The appropriate teaching media comprised audio-visual aids, case studies and manikins to help proper understanding of the content by mothers. And it took about 4 weeks.

Statement of objectives
General objective
The main goal of this program is to improve studied mothers' knowledge, practice and medication adherence level regarding care of children affected with helicobacter pylori infection.

Specific objectives
At the conclusion of this educational program, the mothers studied ought to be able to:

A. Knowledge and understanding skills
- Define stomach
- Identify function of stomach
- Define *H. pylori* infection
- Enumerate mode of transmission
- Mention high-risk groups
- Identify manifestation of *H. pylori* infection
- List screening tests for diagnosis of *H. pylori* infection
- Discuss medical management of *H. pylori* infection
- Define probiotics
- Illustrate type of food help in management of *H. pylori* infection
- Enumerate type of food that irritate the stomach wall
- Mention complication *H. pylori* infection
- Define intrafamilial transmission
- Discuss prevention methods from *H. pylori* infection
- Analyze component of home care for child with *H. pylori* infection
- Discuss importance of medication adherence for eradication of *H. pylori* infection

B. Practical skills
1. Hand washing related practices
- Perform correct hand washing techniques for proper time.
- Practice hand washing before food preparation.
- Practice hand washing after using the toilet.

2. Practice related child hygiene
- Washing the child's hands before and after eating.

- Washing the child's hands before and after using the toilet**.**
- Keeping the child clean after playing with animals
- Avoid sharing childs' personal objects with others.

3. House hygiene practices
- Using chlorine regularly to clean the house.
- Ventilate the house and allow sunlight to enter daily.

4. Food and water supply related practices
- Proper boiling the milk before serving it to the child.
- Wash fruits and vegetables properly.
- Preventing the child from eating food from street vendors.
- Utilize filtered source of water for child uses.
- Good cooking of the meats and eggs.

5. Medication administration related practices
- Prepare correct dosage of medication with correct technique.
- Demonstrate proper technique of oral medication administration.
- Don't give medication to relive symptoms without doctor counselling and don't give the same medication for other infection without physician counselling.
- Keep the medication in suitable temperature away from sun or high temperature.
- Give child adequate amount of water in duration of treatment with antibiotic.
- Follow up with doctor during treatment duration.

Implementation phase
This phase took two months beginning from the beginning of March to the end of April 2021
The implementation phase was achieved through using WhatsApp to communicate with the mothers. The researchers had designed a group on the WhatsApp called: improve mother's knowledge and reported practices level regarding care of children with helicobacter pylori infection and available at: https://chat.whatsapp.com/HGu9R78IYnCHkLtvx4Ctr8.
The researchers added all mothers in (n= 100), viewed all theoretical and practical sessions supported with pictures, videos, and more discussion to facilitate the process of education and to be applicable for all mothers at any time.
The researchers had communicated with the mothers, answered all the questions, and clarify any misunderstanding at any time online.
The implementation phase was achieved through sessions; every session began with a summary of the prior session and the goals of the new one. However, the researchers took into consideration the use of the Arabic language that suited all mothers' educational levels. Moreover, the researchers utilized motivation and reinforcement during sessions to improve sharing in the study.
The total number of sessions was six, distributed as follows: There were three sessions for the theoretical part; every session lasted 60 mins, and there were three sessions for the practical part; each session lasted 60 mins.

The theoretical part included the following:
- **The first session of the educational program included**: definition of stomach, function of stomach, definition of *H. pylori* infection, mode of transmission, high-risk groups, manifestation of *H. pylori* infection and screening tests for diagnosis of *H. pylori* infection.
- **The second session included:** management of *H. pylori* infection, definition of probiotics, type of food help in management of *H. pylori* infection, important of medication compliance ,type of food that irritate the stomach wall and complication *H. pylori* infection.
- **The third session included**: definition of intrafamilial transmission, prevention methods from *H. pylori* infection and home care for child with *H. pylori* infection.

The practical part included the following
The first session of the practical part included: Hand washing related practices and practice related child hygiene.

The second session of the practical part included: House hygiene practices and food preparation practices

The third session of the practical part included: Medication administration practices.

Evaluation phase
This phase took four weeks starting from the end of December 2021 to the end of January 2022. After implementation of the mobile based program, the researchers designed an electronic questioner contains the same pretest tools to assess the impact of mobile based program on the mother's performance level regarding care of children affected with helicobacter pylori infection. And send link to the mothers on the WhatsApp group. Available at: https://forms. office.com/Pages/ResponsePage.aspx?id=IHdfGoEwLkCcy pctfhXITlr83YTjJeVJprbsUp1_iaFUMzZJMkVLSDRTTzZ RNEkzQUVBTkVHRDk0RC4u.

Administrative design
Following a brief description of the study's goal and anticipated results, official letters from the dean of the nursing faculty at Benha University were sent to the directors of the previously listed settings to request their approval to gather the required data for the present research.

Statistical design
Statistical Package for Social Science (SPSS) version 21 for Windows was used to organize, tabulate, and statistically analyze the collected data on an IBM compatible computer. For qualitative variables, data has been represented as numbers and percentages, while quantitative variables have been represented as mean and standard deviation. Qualitative variables have been compared employing Chi-square test. A Fisher exact test has been employed instead when the predicted values are <5. Pearson correlation analysis has been employed to evaluate the interrelation of quantitative variables. P-value <0.05 has been considered statistically significant, and P≤0.001 has been considered highly statistically significant.
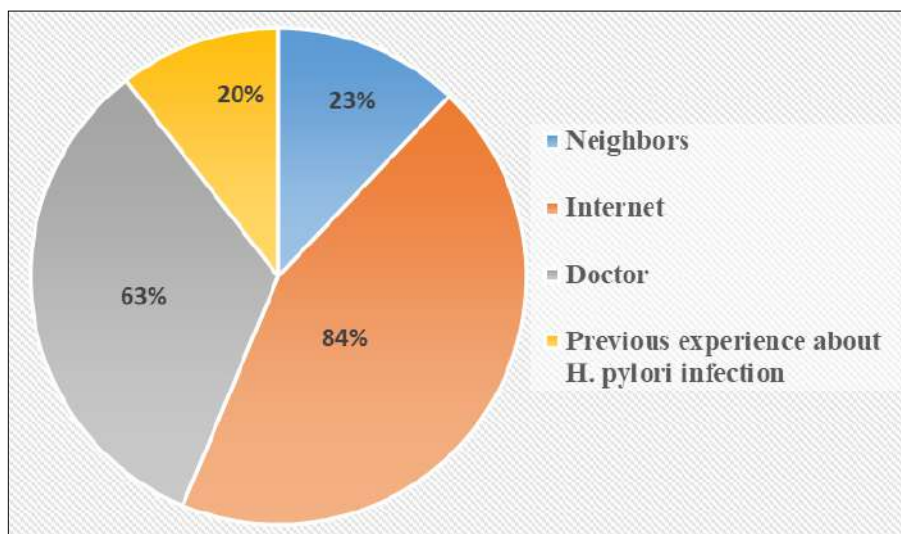
Results

Table 1: Participants and their sociodemograhic Characteristics (n =100)

Mothers ' Characteristics	No.	%
Age/years		
20- < 25	11	11.0
25- < 30	16	16.0
30- < 35	38	38.0
≥ 35	35	35.0
Mean±SD 33.41±5.66 years		
Educational level		
Primary	8	8.0
Secondary	64	64.0
University	25	25.0
Post-graduate studies	3	3.0
Occupation		
Housewife	42	42.0
Employee	40	40.0
Hand working	18	18.0
Residence		
Rural	76	76.0
Urban	24	24.0
Crowding index		
High	72	72.0
Middle	17	17.0
Low	11	11.0
Availability of pure water supply		
Yes	32	32.0
No	68	68.0
Eating from street vendors		
Yes	79	79%
No	21	21%

Table (1) revealed that, (38%) of mothers were in the age group 30<35 years with mean age 33.41±5.66 years, more than half (64%) of them had secondary school and more than two fifth 42% of them were housewife. Regarding their residence; more than three quarters (76%) of them were from rural area, more than two thirds (68%) didn't had pure water supply and (72%) of mothers had high crowding index. Also showed that more than three quarters (79%) of mothers eating from street vendors.

Fig 1: Distribution of the mothers studied based on their sources of information regarding *H. pylori* infection (n= 100)

Figure (1) Clarified that 23%, 84%, 63% and 20% of mothers her sources of information regarding *H. pylori* infection from neighbors, internet, doctors, and previous experience about *H. pylori* infection respectively.

Table 2: Distribution of the children studied based on their characteristics (n =100)

Children' Characteristics	No.	%
Age		
< 3 years	10	10.0
3-<7 years	15	15.0
7-<10 years	50	50.0
> 10 years	25	25.0
Mean±SD 5.32±6.43 years		
Gender		
Female	45	45.0
Male	55	55.0
Educational level		
Illiterate	5	5.0
Nursery school	7	7.0
Primary	50	50.0
Preparatory	25	25.0
Secondary	13	13.0
Previous hospitalization related to *H. pylori* infection		
Yes	**15**	**15.0**
No	**85**	**85.0**

Table (2) illustrated that 50% of children were in the age group from 7-<10 years with mean age 5.32±6.43 years, more than half (55%) of them were male, 50 of them were in primary stage of education and 85% of them had no previous hospitalization related to *H. pylori* infection.
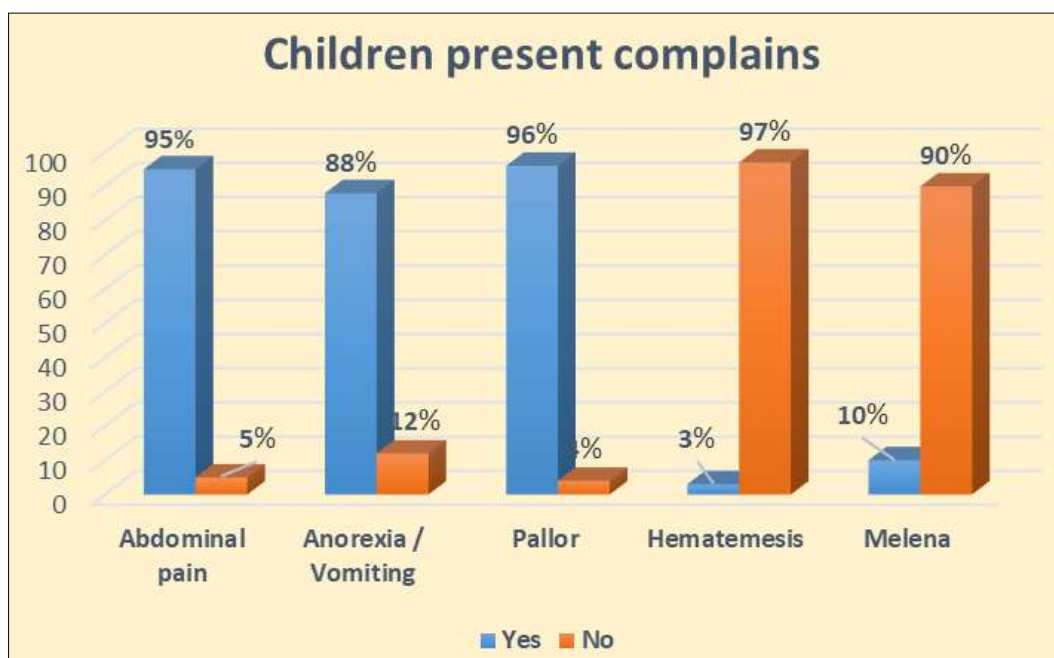

Fig 2: Distribution of the studied children according to present complains from *H. pylori* infection (n= 100)

Figure (2) clarified that 95%, 88%, 96%, 3% and 10% of children suffer from abdominal pain, anorexia or vomiting, pallor, hematemesis, and melena respectively.

Table 3: Mean scores of studied mothers' knowledge regarding *H. pylori* infection pre- and post-program implementation (n =100)
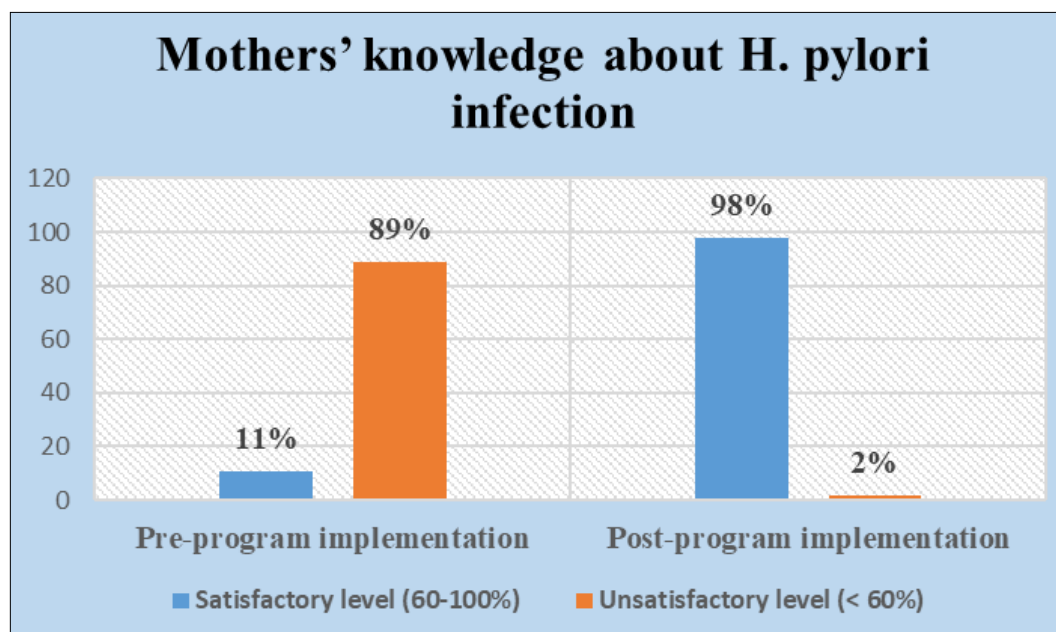
Items	Maximum score	Pre-program (n= 100) Mean ± SD	Post program (n= 100) Mean ± SD	Paired t-test	P-value
Definition of stomach	2	.321±.736	1.84±.545	17.70	0.000**
Function of stomach	2	.880±.326	1.96±.196	39.61	0.000**
Definition of *H. pylori* infection	2	.420±.818	1.78±.628	14.50	0.000**
Mode of transmission	2	.760±.605	1.88±.477	17.49	0.000**
High-risk groups	2	1.18±.386	1.92±.393	14.10	0.000**
Manifestation of *H. pylori* infection	2	.910±.587	1.98±.200	18.12	0.000**
Screening tests for diagnosis of *H. pylori* infection	2	1.17±.377	1.90±.438	13.32	0.000**

Medical management of *H. pylori* infection	2	.110±.314	1.45±.500	26.96	0.000**
Definition of probiotics	2	.160±.368	1.49±.502	26.95	0.000**
Type of food help in management of *H. pylori* infection	2	1.10±.301	1.98±.140	26.94	0.000**
Type of food that irritate the stomach wall	2	1.15±.358	1.96±.196	20.54	0.000**
Complication *H. pylori* infection	2	1.17±.377	1.94±.238	18.20	0.000**
Definition of intrafamilial transmission	2	.570±.573	1.87±.338	22.51	0.000**
Prevention methods from *H. pylori* infection	2	.730±.446	1.73±.446	29.30	0.000**
Home care for child with *H. pylori* infection	2	.680±.468	1.90±.301	28.32	0.000**
Total	30	11.31±3.33	27.07±2.02	44.74	0.000**

**A highly statistical significant difference (P ≤ 0.001)

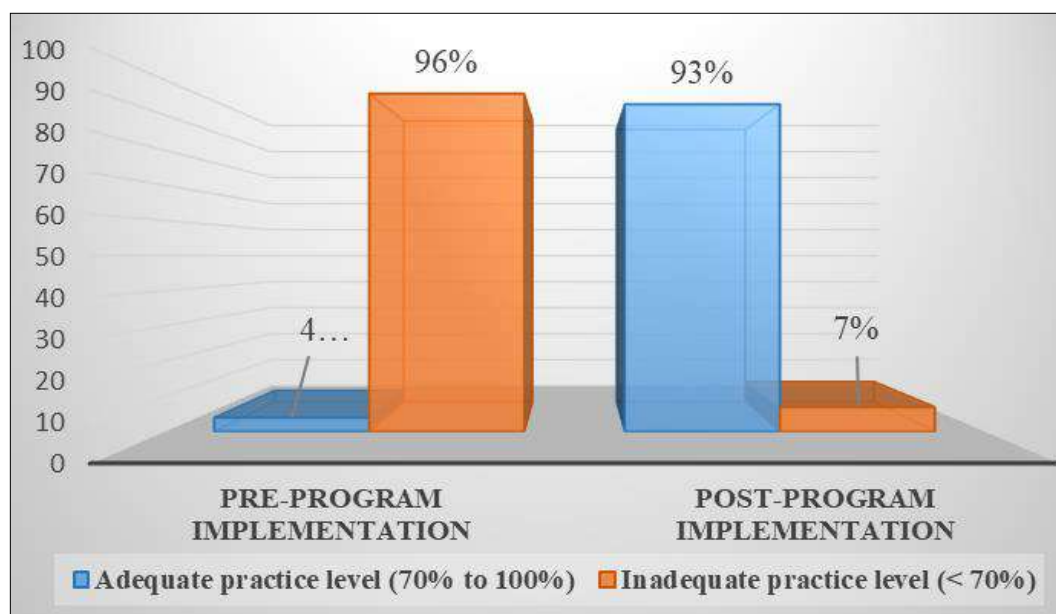Table (3) clarified that, there was highly statistically significant improvement between pre-program and post program regarding mothers' knowledge about *H. pylori* infection (P ≤ 0.000). There was high mean scores of knowledge at post program 27.07±2.02 compared to pre-program phase 11.31±3.33.

Fig 3: Distribution of total level of mothers' knowledge regarding *H. pylori* infection pre and post-program implementation (n =100).

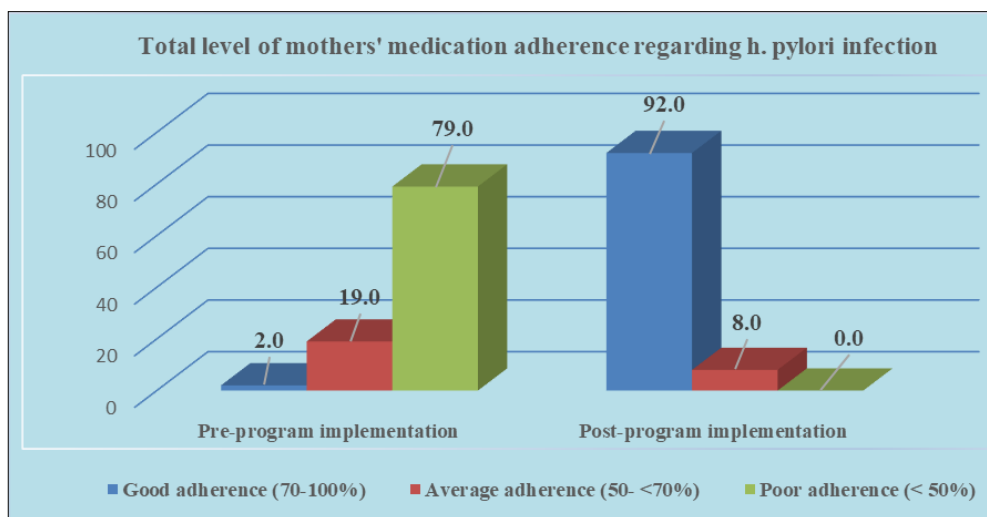Figure (3) portrayed that, (89%) of mothers had unsatisfactory level of knowledge pre-program implementation. In contrast, (98%) of them had satisfactory level of knowledge post-program ($p<0.000$).

Fig 4: Distribution of total level of mothers' reported practice regarding *H. pylori* infection pre and post-program implementation (n =100)

Figure (4) showed that, 96% of mothers had inadequate level of reported practice pre-program implementation. In contrast, 93% of them had adequate level of reported practice post-program implementation.

Fig 5: Distribution of total level of mothers' medication adherence regarding *H. pylori* infection pre and post-program implementation (n =100).

Figure (5): Represented that, more than three quarters (79%) of the studied mothers had poor level of medication adherence in the pre-program. Meanwhile the majority (92%) of them had good level of medication adherence in the post program. Moreover, there was a highly statistical significant difference (*p*<0.000) in favor of post program.

Table 4: Correlation between mothers' total knowledge level, total practice and total medication adherence level pre and post -program implementation (n=100)

Total scores	Pearson correlation coefficient			
	Pre- program implementation		Post- program implementation	
	R	P-value	R	P-value
Knowledge - practice	0.933	0.000**	0.978	0.000**
Knowledge - medication adherence level	0.883	0.000**	0.971	0.000**
Practice - medication adherence level	0.862	0.000**	0.945	0.000**

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

Table (4) illustrated that, there was a highly statistical significant positive correlation between mothers' total knowledge level, total practice level and total medication adherence level pre and post-program implementation (*p*<0.000).

Table 5: Relation between mothers' personal data &their total knowledge score regarding *H. pylori* infection (n=100)

Mothers' personal data	Total knowledge score											
	Pre-educational program						Post-educational program					
	Good level (70-100%)		Average level (50- <70%)		Poor level (< 50%)		X² FET	P-value	Good level (70-100%)		Average level (50- <70%)		X² FET	P-value
	N0.	%	N0.	%	N0.	%			N0.	%	N0.	%		
Age / years														
20: < 25	0	0.0	1	1.0	10	10.0	4.55	.602	11	11.0	0	0.0	3.75	.293
25: < 30	1	1.0	3	3.0	12	12.0			16	16.0	0	0.0		
30: < 35	2	2.0	10	10.0	26	26.0			33	33.0	5	5.0		
≥ 35	3	3.0	4	4.0	28	28.0			31	31.0	4	4.0		
Educational leve														
Primary	0	0.0	0	0.0	8	8.0	118.36	.000	8	8.0	0	0.0	2.80	.422
Secondary	1	1.0	0	0.0	63	63.0			56	56.0	8	8.0		
University	2	2.0	18	18.0	5	5.0			24	24.0	1	1.0		
Post-graduate studies	3	3.0	0	0.0	0	0.0			3	3.0	0	0.0		
Occupation														
Housewife	0	0.0	1	1.0	41	41.0	25.04	.000	42	42.0	0	0.0	14.83	.001
Employee	6	6.0	13	13.0	21	21.0			31	31.0	9	9.0		
Hand working	0	0.0	4	4.0	14	14.0			18	18.0	0	0.0		
Sources of mother's information about *H. pylori* infection:														
1- Neighbor														

	No.	%	No.	%	No.	%	X²	P-value	No.	%	No.	%	X²	P-value
Yes	1	1.0	6	6.0	16	16.0	1.38	.501	14	14.0	9	9.0	33.11	.000
No	5	5.0	12	12.0	60	60.0			77	77.0	0	0.0		
2-Internet														
Yes	5	5.0	16	16.0	63	63.0	.391	.822	84	84.0	0	0.0	51.92	.000
No	1	1.0	2	2.0	13	13.0			7	7.0	9	9.0		
3-Doctor														
Yes	5	5.0	9	9.0	49	49.0	2.44	.295	58	58.0	5	5.0	.235	.628
No	1	1.0	9	9.0	27	27.0			33	33.0	4	4.0		
4-Previous experience about *H. pylori* infection														
Yes	3	3.0	6	6.0	11	11.0	6.82	.033	20	20.0	0	0.0	2.47	.116
No	3	3.0	12	12.0	65	65.0			71	71.0	9	9.0		

Table (5) Reflected that, there is no statistical significant relation between total score of mothers' knowledge and their age, residence, pure water supply, eating from street vendors, crowding index and sources of information about *H. pylori* infection pre educational program implementation ($p>0.05$). However, there is a highly statistically significant relation between total score of mothers' knowledges and their educational level pre-educational program implementation ($p<0.000$). Moreover, there is a highly statistically significant relation between total score of mothers' knowledges and their occupation, residence, crowding index and sources of mother's information about *H. pylori* infection post-educational program implementation ($p<0.000$).

Table 6: Relation between mothers' personal data &their total practice score regarding *H. pylori* infection (n=100)

	Total practice score											
Mothers' personal data	Pre-educational program						Post-educational program					
	Satisfactory		Unsatisfactory		X² FET	P-value	Satisfactory		Unsatisfactory		X² FET	P-value
	N0.	%	N0.	%			N0.	%	N0.	%		
Age/years												
20: < 25	0	0.0	11	11.0	1.55	.671	11	11.0	0	0.0	3.22	.359
25: < 30	0	0.0	16	16.0			14	14.0	2	2.0		
30: < 35	2	2.0	36	36.0			34	34.0	4	4.0		
≥ 35	2	2.0	33	33.0			34	34.0	1	1.0		
Educational level												
Primary	0	0.0	8	8.0	9.08	.028	6	6.0	2	2.0	6.15	.104
Secondary	1	1.0	63	63.0			59	59.0	5	5.0		
University	2	2.0	23	23.0			25	25.0	0	0.0		
Post-graduate studies	1	1.0	2	2.0			3	3.0	0	0.0		
Occupation												
Housewife	1	1.0	41	41.0	.504	.777	39	39.0	3	3.0	.074	.963
Employee	2	2.0	38	38.0			37	37.0	3	3.0		
Hand working	1	1.0	17	17.0			17	17.0	1	1.0		
Sources of mother's information about *H. pylori* infection												
1- Neighbor												
Yes	0	0.0	23	23.0	1.24	.265	21	21.0	2	2.0	.132	.716
No	4	4.0	73	73.0			72	72.0	5	5.0		
2-Internet												
Yes	4	4.0	80	80.0	.794	.373	80	80.0	4	4.0	4.04	.044
No	0	0.0	16	16.0			13	13.0	3	3.0		
3-Doctor												
Yes	4	4.0	59	59.0	2.44	.118	57	57.0	6	6.0	.166	.197
No	0	0.0	37	37.0			36	36.0	1	1.0		
4-Previous experience about *H. pylori* infection												
Yes	0	0.0	16	16.0	16.66	**.000**	18	18.0	2	2.0	.346	.557
No	4	4.0	80	80.0			75	75.0	5	5.0		

Table (6) Revealed that, there is no statistical significant relation between total score of mothers' practice and their age, residence, pure water supply, eating from street vendors, crowding index and sources of information about *H. pylori* infection pre and post educational program implementation ($p>0.05$). However, there is a highly statistically significant relation between total score of mothers' practice and their previous experience about *H. pylori* infection pre-educational program implementation ($p<0.000$).

Discussion

One of the most prevalent chronic infections is Helicobacter pylori (*H. pylori*), which affects roughly 50% of people globally. Such an infection is most commonly acquired throughout early childhood, particularly in developing nations. Helicobacter pylori was identified as the cause of chronic gastritis. Nevertheless, extra-digestive influences on growth parameters in young children were documented. Numerous studies have linked *H. pylori* infection to an impairment in children's growth [2].

In terms of mothers' characteristics, the present study found that more than a third of the studied mothers belonged in the age group of 30<35 years, with an average age of 33.41±5.66 years. This conclusion was in the same context as Agossou *et al*. 2020 [14] who performed their research on *H. pylori* Infection (Hp) among children in the Northern Benin in 2018 and stated that the mean ages of the parents of children with *H. pylori* infection were 32.80±6.62 years for mothers and 40.82±8.48 years for fathers.

Regarding the educational level of the mothers examined, the current research found that less than two-thirds of them possessed a secondary school certificate. This result is supported by Salih *et al*. 2017 [15] who conducted a study about the incidence of *H. pylori* among Sudanese children hospitalized at a specialist children's hospital and reported that 49% of the children's mothers had a high school certificate. On the other hand, this finding is contraindicated with Galal 2019 [2], who conducted a study about *H. pylori* infection in symptomatic Egyptian children: incidence, risk factors, and growth effects and found that more than half of the mothers (61%) were not educated and showed that illiteracy of mothers was significantly associated with *H. pylori*.

Regarding the occupation of studied mothers, the present research clarified that less than half of mothers are housewives. This study's results were parallel with those of Spotts *et al*. 2020 [16], who investigated concurrent intestinal parasite and H pylori infections in school-aged children in Central Ethiopia and found that (45%) of the mothers of the children studied were housewives.

The current research findings about the mothers' residences revealed that more than two-thirds of them came from rural areas. These findings are supported by several prior research findings by Galal *et al*. 2019 [2] and Gravina *et al*. 2016 [17] who noted that the *H. pylori* prevalence rate is high in rural areas. This may be due to increase household crowding index, unsafe water supply and lack of nutrition education in rural area.

The finding of the current study was reported that more two thirds didn't had pure water supply and had high crowding index. Researchers viewed that this fact more precipitates to *H. pylori* infection though enhancing intrafamilial transmission by using and sharing the same personal objects This conclusion was in the same context as the findings of Aitila *et al*. 2019 [18], who conducted research on the incidence and risk factors of *H. pylori* among children aged 1 to 15 years in Mbarara, South Western Uganda, at Holy Innocents Children's Hospital, and found that the rate of infection had been higher in children who used to have an unsafe supply of water at home, no sanitary facility at home, overcrowded families, or an unsafe origin of drinkable water (*p*<0.001). This result is consistent with the findings of Mohammed *et al*. [10], who did research on educational interventions to improve drug adherence, awareness, and practise concerning intrafamilial transmission in patients with *H. pylori* and found that more than half of both groups had a high crowding index (≥3 members per room). Also, it was supported by several other studies who reported that household crowding index was found to be significantly related to positive infection of *H. pylori* [2, 19].

According to the current research, more than 75% of mothers were found to be eating from street vendors. This

study's results were supported by Monno *et al*. 2019 [20], who did research on *H. pylori* infection: connection with food habits and socioeconomic circumstances and found that eating food from street sellers and having meals away from home were strongly related to infection with *H. pylori*. This result was in harmony with research by Ahmed *et al*. 2014 [21] on the transmission of *H. pylori* from food cooked and consumed under sanitary and unsanitary conditions: a preliminary study employing biopsy samples found that individuals who bought and consumed food from street vendors on a daily basis had a prevalence of 90.9%, whereas those who consumed the food products once a week or once a month had a lower incidence. Those who never purchased food from street sellers had a lower incidence of 42.7%.

The current study reported that majority of mothers sources of information regarding *H. pylori* infection from internet. From the point of view of researchers, given the widespread usage of the internet, it can play a significant role in spreading health knowledge and helping patients and their families get the assistance they need to manage their illness. This finding is supported by Kubb & Foran 2020 [22], who did research titled "Online Health Information Seeking by Parents for their Children: Systematic Review and Agenda for Further Research." Parents all over the world are frequent users of the internet to find health-related data for their children under a wide range of conditions. This finding was in parallel with the findings of a study by Nicholl *et al*. [23] titled "Internet Use by Parents of Children with Rare Conditions: Findings from a Study on Parents' Web Information Needs," which reported that parents routinely and habitually utilized social media and the internet to learn about their child's condition.

In terms of the characteristics of the children tested, the present research's results showed that half (50%) of children were in the age group of 7-<10 years, with a mean age of 5.32±6.43 years. This result agrees with Aitila *et al*. 2019 [18] who reported that infection with Helicobacter pylori was most prevalent in children aged 6 to 10. This result is supported by Gala *et al*. 2019 [2] who found that the median age of the participants was 7 years, with a range of 1 to 15 years. With no significant differences, children over the age of ten had the highest frequency of *H. pylori* infection (32.9%), whereas those under the age of three had the lowest (13.8%), excluding sex and age.

The current study also showed that 55% of the studied children were male. The results of this research agreed with those of Deng *et al*. [24], who investigated the antibiotic resistance of *H. pylori* strains obtained from Southwest China pediatric patients and found that patients who were found to be *H. pylori* positive (53%) were boys.

This current study reported that majority of children had no previous hospitalization related to *H. pylori* infection. This finding supported by Ibrahiem & Saad 2021 [25] who reported regarding previous infectious diseases among family members that only about 14.7% of family member had a history of *H. pylori* infection.

Regarding mothers' medication adherence, the present research found that more than three-quarters of the studied mothers exhibited poor levels of medication adherence in the pre-program. Meanwhile the majority of them had good level of medication adherence in the post program. In addition, mothers' medication adherence levels for *H. pylori*

infection showed a highly statistically significant improvement between pre-program and post-program ($P \leq 0.000$). The view point of researchers that, these findings reflect the effectiveness of the mobile based educational program. These findings were parallel with those of Mohammed *et al*. [10], who found that 74% of the study group and 42% of the control group adhered to H pylori eradication therapy, showing a statistically significant difference in P-value (0.001).

On assessing children complain, the present study reported that 95%, 88%, 96%, 3% and 10% of children suffer from abdominal pain, anorexia or vomiting, pallor, hematemesis, and melena respectively. This result is supported by a study conducted by Xiaohong *et al*. [26], who found that symptoms of the digestive tract in children with *H. pylori* infection comprise reflux, pain in the abdomen, epigastric pain, vomiting, nausea, hematochezia, and peptic ulcers. Abdominal pain was the most frequent among them, while reflux, nausea, vomiting, as well as hematochezia were the least frequent. This result was in accordance with Galal (2019) [2], who found that pain in the abdomen, vomiting, hematemesis, as well as pallor were clinical signs and symptoms that were significantly related to a positive *H. pylori* infection.

The current study showed a highly statistically significant difference in total mothers' knowledge level between pre- and post-program implementation, whereas the majority of mothers had an unsatisfactory level of knowledge pre-program implementation, which indicated that they didn't have knowledge about Helicobacter-pylori. In contrast, the majority of them possessed satisfactory post-program knowledge levels ($p < 0.000$), which indicated the effectiveness of the mobile-based educational program for improving mothers' knowledge levels. The result of this study was in harmony with Ibrahiem & Saad 2021 [25], who reported that in the pre-test the vast majority of the family members' means±SD in all knowledge items were very low, which indicated that they didn't have any knowledge about Helicobacter-pylori. After implementing the health awareness package, there were highly statistically significant improvements were observed in the family members' mean scores in all tested items of knowledge ($P > 0.000$).

On investigating mothers' practices level regarding the care of their children with Helicobacter-pylori the present study revealed that, majority of mothers had inadequate level of practice pre- mobile based program implementation. In contrast, majority of them had adequate level of practice post-program. Furthermore, there was a highly statistically significant difference among studied mothers before and after program implementation in relation to reported practice regarding *H. pylori* infection ($p < 0.001$). This indicated an improvement in mothers' practice post-implementation of the mobile-based program, which may be due to the efficient application of the mobile-based program. This result was in line with that of El Husseniy *et al*. [27], who conducted research on the impact of mobile-based learning compared to booklet-based learning on mothers' knowledge and practice regarding their children with bronchial asthma. They reported that one month after receiving mobile-based learning, the mobile-based learning groups displayed improvements in their overall level of knowledge and practice

The current study reported a highly statistically significant positive link among mothers' total knowledge level, total practice level, and total medication adherence level before and after program implementation ($p < 0.000$). The result of this study was in harmony with Ibrahiem & Saad 2021 [25], who found a statistically significant, highly positive association between the total of knowledge scores and reported practices pre and post receiving a health awareness package ($p > 0.001$). This study agreed with Aravindalochanan *et al*. [28], who conduct study about the effect of the health awareness package prevention of school childhood obesity and confirmed in this study that the radical positive significant effect on both knowledge and practice reported levels. It means that family members should be acquainted with adequate knowledge related to the prevention of *H. pylori* infection to improve their practices

It is reflected that there is no statistically significant relation between moms' total knowledge score and their residence, pure water supply, eating from street vendors, crowding index, and sources of information about *H. pylori* infection pre-educational program implementation ($P > 0.05$). This finding contradicted that of Deeb *et al*. [29], who discovered a highly significant difference among seropositive and seronegative patients in terms of family crowding, number of family members, number of rooms and bed sharing, and residence area ($P = 0.001$), denoting those cases with higher family crowding and those residing in slums had a higher prevalence of infection.

The findings of the present research were reported to show that there is a highly statistically significant relation between the total score of mothers' knowledge and their educational level in pre-educational program implementation ($p < 0.000$). The finding of this study was supported by Ibrahiem & Saad 2021 [25], who found highly statistically significant relationships between family members' socio-demographic characteristics' such as educational level, regarding total scores of knowledge pre and post health awareness package ($P = 0.000$).

The present investigation demonstrated there's no statistically significant relation between the total score of mothers' practice and residence, crowding index, and sources of information about *H. pylori* infection pre and post educational program implementation ($P > 0.05$). This finding contradicted with Ibrahiem & Saad 2021 [25] who reported that there was statistically significant relationships between family members' educational level and no. of family members with their total scores of reported practices pre and post health awareness package where ($p > 0.05$). As well as a highly statistically significant relationship between occupation and crowding index with total scores of reported practices with (p = 0.000).

The present research showed that there was no statistically significant relation between mothers' medication adherence score and their occupation, residence, pure water supply, eating from street vendors, and sources of information about *H. pylori* infection pre-educational program implementation ($P > 0.05$). However, there is statistically significant relation between mothers' medication adherence score and their age, educational level, and crowding index pre-educational program implementation ($p < 0.003, 0.000$,) respectively.

Moreover, there no statistically significant relation between mothers' medication adherence score and their personal data post educational program implementation ($P>0.05$). This result was in harmony with the findings of O'Connor et al. [30], who did research on enhancing compliance using *H. pylori* eradication treatment: how and when. Advances in gastroenterology therapy reported that adherence to the drug regimen among infected patients with *H. pylori* was improved by education and found that patients who received more knowledge about their disease and the significance of medication compliance achieved significantly higher levels of eradication and compliance. This is also, supported by the study of Shakya et al. 2016 [31], who found that educational interventions to improve patients' attitudes towards treatment and enhance their knowledge of medication achieved the goal of successful treatment.

Conclusion
According to the present study's findings, it could be concluded that mobile-based education was effective in improving mothers' performance regarding care of their children with Helicobacter pylori infection. Again, there has been a very statistically significant positive link between mothers' overall knowledge level, overall practice level, and overall medication adherence level before and after the implementation of the mobile-based program ($p<0.000$).

Recommendations
These points are recommended based on the current study's findings
- For mothers of children with Helicobacter pylori infections, healthcare practitioners can employ mobile-based educational techniques to promote their children's health.
- Applying mobile based health education about *H. pylori* infection on a large sample in different settings to confirm the current results.
- Further studies are recommended to investigate the factors influencing the mothers' medication adherence.

Declaration of Conflicting Interest
The authors declare no conflict of interest.

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Authors' Contributions
HT: conception of the work, data analysis and reviewed draft manuscript. FM: conception of the work, data acquisition, data analysis, and reviewed draft manuscript. RE: conception of the work, data acquisition and analysis. All authors revised the manuscript and provided final approval of the version to be published.

Data Availability
The datasets generated during and/or analyzed during the current study are not publicly available due to ethical restrictions but are available from the corresponding author on reasonable request

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