Effect of Educational Guidelines on Adherence of Patients with Viral Hepatitis C toward New Oral Therapeutic Regimen

Sahar, A. Hassan[1], Salwa, S. kamel[2], Manal, S. Hassan[3], Asmaa, A. Saleh[4]

[1]Member of Infection Control Team, Beni Suef Health Directorate, Beni Suef, Egypt.
e-mail: sahar0112022@gmail.com

[2]Medical-Surgical Nursing Department, Faculty of Nursing, Ain Shams University, Cairo, Egypt.
e-mail: dr.salwa.samir@nursing.asu.edu.eg

[3]Medical-Surgical Nursing Department, Faculty of, Nursing Ain Shams University, Cairo, Egypt.
e-mail: dr.manal.salah@nursing.asu.edu.eg

[4]Medical-Surgical Nursing, Faculty of Nursing, Ain Shams University, Cairo, Egypt.
e-mail: dr.asmaa.saleh@nursing.asu.edu.eg

ABSTRACT

Context: Viral hepatitis was estimated to be the seventh leading cause of mortality globally. One of the countries most affected by the hepatitis C virus is Egypt.

Aim: This study aimed to evaluate the effect of educational guidelines on the adherence of patients with viral hepatitis C toward a new oral therapeutic regimen**.**

Methods: A quasi-experimental research design (one group pretest-posttest) was utilized to achieve the aim of this study. This study was conducted in the hepatitis C treatment clinic at Beni Suef general hospital on a purposive sample of 94 patients with viral hepatitis C. The study tools include patients' assessment questionnaire to assess sociodemographic characteristics of patients, current and past medical history, and patients' knowledge regarding hepatitis C and its new oral medication, patient adherence assessment scale to assess the level of patients' adherence to therapeutic regimens were used to collect the current study's data.

Results: The study showed that 72.3% of studied patients adhered to the therapeutic regimen post-implementation of the educational guidelines compared to 54.3% pre-implementation, with a statistically significant difference at $p < 0.05$.

Conclusion: Implementation of the educational guideline had a statistically significant positive effect on improving HCV patients' adherence to the therapeutic regimen. The study recommended designing an Arabic educational material about HCV and the management needed during treatment to be given to every patient. Close involvement of the individuals and their families in decision-making about disease management to improve patient adherence.

Keywords: Educational guidelines, hepatitis C, adherence, oral therapeutic regimen

1. Introduction

Viral hepatitis was estimated to be the seventh leading cause of mortality globally. An estimated 58 million people have chronic hepatitis C virus infection, with about 1.5 million new infections occurring per year. Approximately 290,000 people died from hepatitis C, mostly from cirrhosis and liver cancer *(WHO, 2022).*

The World Health Organization (WHO) has recently developed the "Global Health Sector Strategy on Viral Hepatitis, 2016–2021," with service coverage targeting eliminating HCV as a public health threat by 2030. WHO defined elimination as a 65% reduction in mortality and a 90% reduction in incidence, compared with the 2015 baseline data *(Hassanin et al., 2021).*

Egypt launched an ambitious national HCV treatment program aiming to treat over 250,000 chronically infected individuals per year, with the goal of achieving a national chronic infection prevalence of <2% by 2025 *(Kouyoumjian et al., 2018).*

The standard care to treat HCV infection was an injection of pegylated interferon (PEG-IFN) and daily ribavirin medication. This regimen was expensive, toxic, and complicated to deliver and its cure rates were less than 50%, especially for people with liver cirrhosis. Since 2014, most people can be cured of HCV infection with the new oral direct-acting antivirals (DAAs), that different target steps of the reproductive cycle of HCV *(Abbasy et al., 2021).*

Evaluating adherence to DAAs regimens is vital to translating the high efficacy of these regimens. In particular, adherence is important to attaining the maximal rate of sustained virologic response (SVR) from a treatment regimen, avoiding treatment failure, and developing DAAs resistance *(Ali et al., 2021).* The definition of adherence varies; it can be defined as the completion of at least 80% of treatment or taking all prescribed medications and attending all follow-up visits *(Ahmed et al., 2021).*

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[1]*Correspondence author: Sahar Ali Hassan*

Among patients enrolled in hepatitis C treatment programs, higher patient knowledge has been associated with reduced non-adherence to follow-up. In contrast, other educational interventions, such as single-session group educational interventions and multi-session one-on-one educational interventions, have been associated with increased willingness to initiate treatment, reduced time to treatment initiation, increased adherence, and increased likelihood of sustained virologic response (SVR) *(Barnhart et al., 2021).*

Nurses play an important role in managing and caring for patients with hepatitis C receiving Sovaldi combination therapy. They educate patients about the disease and its prevention; educate them against behaviors that increase the threat of re-infection and spread the infection to others; identify and address any adaptable risk factors and psychosocial factors; educate them about treatment, nutrition, medication, personal hygiene, and assess the patient desire for treatment; give the support during treatment; ensure referral to a specialist for hepatitis C; monitor for the occurrence of complications and determine the patient need for support services *(AbdEllatef & Mohamed, 2019).*

2. Significance of the study

Egypt is one of the countries that are most affected by HCV. According to the Egyptian Health Issues Survey (EIHS) data, 14.7% of people aged 15–59 years had an active hepatitis infection in 2009, which decreased to 7% in 2015 *(Metwally et al., 2021).* Thus, the eradication of HCV is a crucial aim to overcome these complications and prevent the further spread of HCV infection. With the introduction of direct-acting antiviral (DAA), HCV treatment has been drastically changed. Treatment with these agents showed safety, efficacy, and a higher rate of sustained virologic response *(Hassanin et al., 2021).*

Adherence to HCV treatment plays a critical role in improving treatment outcomes. In contrast, non-adherence to prescribed treatment regimens for hepatitis C viral infection has been a major barrier to treatment success. This study can add to the body of knowledge in several ways. Firstly, it can help identify the most effective educational guidelines to improve patient adherence to new oral therapeutic regimens for viral hepatitis C. It can be useful for healthcare professionals in developing countries with limited access to newer medications.

Secondly, the study can also provide insights into the barriers that patients with viral hepatitis C face in adhering to new oral therapeutic regimens. These insights can be used to develop targeted interventions to improve patient adherence and treatment outcomes. Finally, the study can contribute to the growing research on viral hepatitis C and its management. It can be useful for researchers and healthcare professionals interested in this area and can help advance the understanding of the disease and its treatment.

3. Aim of the study

This study aimed to evaluate the effect of educational guidelines on adherence of patients with viral hepatitis C toward new oral therapeutic regimen through:

- Assessing patients' with viral hepatitis C adherence toward oral therapeutic regimen before implementing educational guidelines.
- Assessing the level of knowledge of patients with hepatitis C regarding the new oral therapeutic regimen.
- Develop and implement the educational guidelines.
- Evaluate the effect of educational guidelines on adherence of patients with viral hepatitis C toward oral therapeutic regimen.

3.1. Research hypothesis

The current study hypothesized that implementing the educational guidelines would positively affect the adherence of patients with viral hepatitis C toward an oral therapeutic regimen.

4. Subjects & Methods

4.1. Research Design

The research was used quasi experimental design (one group pretest - posttest) to achieve the aim of the present study. Quasi-experimental designs are generally used to establish the causality (effect of the independent variable on the dependent variable) in situations where researchers are not able to randomly assign the subjects to groups or for various reasons in certain situations cannot have a control group for comparison in an experimental study *(Sharma, 2018).*

4.2. Study setting

This study was conducted in the hepatitis C treatment clinic at Beni Suef general hospital. The hepatitis treatment clinic is located on the hospital's third floor of an outpatient building. It consists of two clinics for hepatitis C and B virus, a pharmacy, a file room, a registration room, and a nursing room. This hospital serves all sectors of people in the Beni Suef governorate.

4.3. Subjects

A purposive sample of 94 patients with viral hepatitis C was recruited for the conduction of this study from the settings mentioned above. The sample size was calculated based on power analysis. The estimated sample size is 94 out of 3000 patients who attend the previously mentioned setting at a confidence level of 95%. The Steve Thompson formula was used to calculate the sample size *(Vincent & Thompson, 2014).*

$$n= \frac{N \times P(1-P)}{\{N-1 \times (d^2/Z^2)\} + P(1-P)\}}$$

$$\frac{3000 \times 0.5(1-0.5)}{\{2999 \times (0.5d^2/1.96^2)\} + 0.5(1-0.5)\}}$$

Which:
n= Sample size
N=Total society size
Z= The corresponding standard class of significance 95
d= error percentage = (0.05) = 1.96

P= Percentage of availability of the character and objectivity= (0.1)

d= error percentage = 0.05

Type I error with significant level (α) = 0.5 with significant level 95%.

Type II error by power test (1-B) = 80%.

Patients were selected according to the following criteria

Inclusion criteria

Adult patients of both sexes were diagnosed with chronic hepatitis C at the beginning of the treatment therapy and were willing to participate in the study.

Exclusion criteria:

Patients with mental and psychiatric disorders and hepatitis B, and those who exposed to an educational program before were excluded from the study.

4.4. Tools of data collection

4.4.1. Patients' Assessment Questionnaire

The researcher developed this tool based on an extensive review of relevant and recent literature *Ambrose et al. (2022); EASL (2019); Ignatavicius et al. (2018); Hinkle and Cheever (2018); AASLD (2018).* It was written in simple Arabic and included two parts as following:

Part 1 assessed the Socio-demographic characteristics of patients. This part is composed of ten questions used to assess the patient's sociodemographic characteristics such as gender, age, level of education, marital status, occupation, work type, monthly income, residence, smoking status, and health care provider at home.

Part 2 was used to assess patients' level of knowledge regarding hepatitis C and its new oral therapeutic regimen pre- and post-implementation of guidelines. It is composed of seven sections, which included 32 multiple-choice questions and 6 (yes or no) questions. They were distributed as (6) questions about patients' knowledge of the hepatitis C virus, (2) questions about hepatitis C therapeutic regimen, (10) questions about pharmacological treatment, (10) questions about appropriate diet and fluid, (2) questions about daily activity, (3) questions about follow up, (5) questions about measures required to reduce the medication side effect.

Scoring system

The correct answer was given one grade, and the incorrect answer was given (zero). The total degree was (38), the satisfactory level of patients' knowledge was ≥60% (≥ 23 degrees), and the unsatisfactory level of patients' knowledge was less than 60% (<23 degrees).

4.4.2. Patient Adherence Assessment Scales

They were assessed the patient's adherence to the therapeutic regimen. It consisted of two scales.

4.4.2.1. Morisky Medication Adherence Scale (MMAS)

This dichotomous scale was adopted from *Morisky et al. (2010).* It was translated into Arabic. It comprises eight closed-ended questions used to assess the adherence of patients with viral hepatitis C to medication therapy.

Scoring system

Morisky Medication Adherence Scale scored by assigning (1) degree for each question answered "No" and (0) for each question answered "Yes" in questions from 1-7 except question no. 5; One is given for an answer of "Yes" and 0 for an answer of "No," question 8 was scored as never 1, rarely 0.75, sometimes 0.5, usually 0.25, always zero. The total score for the adherence scale was (8 grades). Patients were categorized as adherent and non-adherent as follows:

- ≥80% (≥6 from the total score of 8) was adherent.
- <80 % (<6 from the total score of 8) was non-adherent.

4.4.2.2. Patient Adherence Assessment Scale

This tool was developed by the researcher in Arabic, based on reviewing the related literature of *Chen et al. (2020); Kizior and Hodgson (2019); EASL (2019); Two et al. (2018); Wohl et al. (2017), Monaghan et al. (2017).* It composed of (17) closed-ended questions. They were distributed as (10) questions to assess diet, (3) questions to assess daily exercise, and (4) questions to assess follow-up.

Scoring system

The correct answer was given (one grade), and the incorrect answer was given (zero); question No (18, 21, 23) was scored as all the week 1, 3-5 time per week 0.75, two times per week 0.5, once a week 0.25, non- zero.

The total grade was (17 grades). Patients were categorized as adherent and non-adherent as follows:

- ≥80% (≥14 from 17) were considered adherent.
- <80 % (< 14 from 17) were considered non-adherent.

The total score for both Patient adherence assessment scales were (25 grades). Patients were categorized into adherent and non-adherent as follows:

- ≥80% (≥20 degrees) adhered to the therapeutic regimen.
- <80% (<20 from the total score of 25) was considered non-adherent to the therapeutic regimen.

4.5. Procedures

Testing the face validity of the proposed tools was done by inspecting the items to determine whether the tools measured what they were supposed to measure. The data collection tools were examined for content validity by a jury of seven experts, five from Medical–Surgical Nursing Department, Faculty of Nursing of Ain Shams University (2 professors and three assistant professors). The other two members were hepatologist consultants working in the liver and endoscopy department at Beni Suef general hospital. The experts reviewed the tools for clarity, relevance, comprehensiveness, simplicity, and minor modifications.

Cronbach's alpha assessed the tool to check the internal consistency. It was as follows, patients' knowledge regarding hepatitis C and its new oral medication was 0.91, which means highly reliable. Tool II, entitled patients' adherence assessment scales, was 0.89.

Ethical Considerations: Before conducting the study, ethical approval was obtained from the Scientific Research and Ethical Committee of the Faculty of Nursing of Ain Shams University. The researcher clarified the objectives

and aim of the study to the patients included in the study. Then verbal consent was obtained from patients to participate in the study. They were assured of maintaining anonymity and confidentiality of their data. An administration approval letter was issued from the National Committee for Control of Viral Hepatitis to the director of Beni Suef general hospital and the hepatitis C treatment clinic at which the study was conducted.

A pilot study was carried out on 10% of the studied subjects (10 patients). It was carried out in the hepatitis C treatment clinic at Beni Suef general hospital to assess the clarity of the designed tools, the applicability of the tools, the time needed for filling data collection tools, and the feasibility of the research process. The subjects who were included in the pilot study were included in the main study subjects.

Fieldwork included four phases: Assessment, planning, implementation, and evaluation phase. The study was carried out in the waiting areas of the hepatitis C treatment clinic. The study was carried out in four cycles, where 23 patients were taken in each cycle, except the last cycle was 25. Each cycle lasted three months and included 4 phases: The assessment and planning phases in the first month, the implementation phase in the second month, and the evaluation phase in the third month.

Data collection and teaching sessions lasted 12 months. They were conducted in the morning shift 3-5 days per week according to patients' schedules, from the beginning of September 2019 until the end of August 2020. All COVID precautions were taken guided by the periodical guidelines issued from the Egyptian Ministry of Health and Populations.

Assessment phase: This phase was started by interviewing patients with hepatitis C who were taking new oral treatments and met the inclusion criteria. The aim and nature of the study were explained to patients as well as obtaining their approval to participate in the study prior to data collection. The patients' telephone numbers were obtained the first time for contacting them to complete the data collection process.

The patient assessment questionnaire was used to assess patients' knowledge regarding the hepatitis C therapeutic regimen to identify the patients' educational needs. The researcher filled in this tool. It took about 20-30 minutes to be filled in according to the patient's condition. Patients' adherence assessment scales were used to assess patients' adherence to the therapeutic regimen. The researcher filled in this tool. It took about 10-15 minutes.

Planning phase: All data collected regarding patients' knowledge and adherence to the therapeutic regimen was analyzed to identify patients' needs. Based on patients' needs, the researcher developed an educational guideline in Arabic after reviewing the related literature *Hinkle and Cheever, (2018); Ignatavicius et al. (2018); Dibba et al. (2018); Martinello et al. (2018).*

It included the following content: Anatomical function of the liver, hepatitis C definition, causes, clinical manifestation, complications, diagnostic procedures, protocol for treatment, nursing instructions to be followed while taking medicine, therapeutic regimen, and instruction

to improve adherence to the therapeutic regimen. The same panel of experts who judged the study tools validated the guidelines.

Implementation phase: Teaching sessions were conducted for every patient individually. The educational guideline was handed out to every patient, and the content was explained over 3-4 sessions according to the patient's condition, with 30 minutes for every session. The first teaching session included the nature of the disease, the second was about the treatment protocol, and the third was about instructions that should be followed during treatment therapy. The fourth teaching session was about the therapeutic regimen and instructions to improve adherence to it. Patients could ask questions in case of misunderstanding while listening and expressing interest.

At the end of these sessions, the researcher emphasized the importance of follow-up visits and informed them that the researcher would evaluate them after one month after the last session.

Evaluation phase: Post implementation of the educational guideline, all tools except sociodemographic data were refilled again after one month. Evaluation of the effect of the educational guideline on patients' knowledge and level of adherence to the therapeutic regimen was evaluated by comparing the results pre and post-implementation of the educational guideline using the same data collection tools after one month.

4.6. Data Analysis

The data were collected, tabulated, and subjected to statistical analysis. Statistical tests were conducted using SPSS for windows version 25.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean and standard deviation (SD). The chi-square test was used for the comparison of variables with categorical data. Pearson correlation analysis was used to assess the inter-relationships among quantitative variables. Statistical significance of the observed differences and association were considered as follows: Non-significant at $p > 0.05$, significant at $p \leq 0.05$, and highly significant at $p < 0.001$.

5. Results

Table 1 shows that slightly more than half of the studied patients were females (55.3%), and 54.3% of patients ages ranged between 26-<41 years old, with a mean age of 33.69±11.42. Regarding educational level, it was revealed that two-fifths (41.5%) of patients could not read and write, and near three-quarters (74.4%) were married. According to occupation, 63.8% of patients do not work/retired. Furthermore, 83% of the patients reported insufficient income to meet their needs. Finally, 91.5% of the studied patients live in rural areas. 23.4% were smokers, 40.9% of them smoked ten cigarettes per day, and 68.2% smoked for less than five years. 58.5% of the studied patients had no home care provider.

Table 2 shows a statistically significant difference in patients' knowledge level regarding HCV, HCV therapeutic regimen, pharmacological treatment, appropriate diet and

fluid, daily activities, and follow-up pre-and post-implementation of educational guidelines as p-value <0.05. It also clarifies that 3.2% of studied patients had a satisfactory level of knowledge about HCV and its therapeutic regimen pre-implementation of educational guidelines compared to 59.6% of patients post-implementation of educational with a statistically significant difference between the two study phases.

Table 3 clarifies a statistically significant difference in patients' level of adherence to medication, diet, and daily activity pre-and post-implementation of educational guidelines as p-value <0.05. The patients' follow-up shows a non-statistically significant difference between pre-and post-implementation of the educational guidelines as most patients were already followed up (90% Vs. 92% pre and post-implementation).

Figure 1 reveals the total level of adherence to the therapeutic regimen that 72.3% of studied patients adhered to therapeutic regimens post-implementation of educational guidelines compared to 54.3% pre-implementation of educational guidelines.

Table 4 clarifies a statistically significant relation between patients' total knowledge level and patients' total level of adherence regarding medication, diet, and daily activities post-implementation of educational guidelines.

6. Discussion

Hepatitis C virus (HCV) infection is a major public health threat due to the disease burden and risk of complications. The development of an effective therapy using direct-acting antiviral agents to cure the infection by the hepatitis C virus has made it even more important to assure adherence to treatment. The treatment adherence is a dynamic, multi-factor process that needs to be examined, evaluated, and understood to be enthused in hepatitis C treatment with direct-acting antiviral agents *(Coco et al., 2021)*. This study aimed to evaluate the effect of educational guidelines on adherence of patients with viral hepatitis C toward new oral therapeutic regimen.

One of the noticeable findings regarding patients' knowledge is that there was a highly statistically significant difference between the total level of knowledge about hepatitis C and its therapeutic regimen pre- and post-implementation of the educational guideline, where near two-thirds of patients had a satisfactory level of knowledge post implementation of the educational guideline compared to a minority of them pre-implementation of educational guideline. This result reflects the improvement in the level of patient awareness post-educational guideline. This finding may be attributed to the effectiveness of educational guidelines in enhancing patients' knowledge.

The current study is similar to *Sheha et al. (2020),* who stated that mothers' knowledge was improved after the application of educational programs from 68.2% to 90% in a study that evaluated the effects of educational program on mother's knowledge and practice regarding hepatitis C in the rural areas. In addition, *El Malky et al. (2016)* reported that

a highly statistically significant improvement in patient's knowledge about antiviral treatment therapy (Sovaldi) and its side effects post-application of an educational program in a study that evaluated the effectiveness of nursing intervention program on emotional distress, self-efficacy, and liver enzymes among hepatitis C virus patients undergoing antiviral treatment therapy (Sovaldi medication).

Table (1): Frequency and percentage distribution of sociodemographic characteristics of studied patients (n=94).

Patients' characteristics	No.	%
Gender		
Male	42	44.7
Female	52	55.3
Age group		
18-<26 years	26	27.6
26-<41 years	51	54.3
41-<51 years	9	9.6
51-60 years	3	3.2
> 60 years	5	5.3
Mean age ± SD	33.69±11.42	
Educational level		
Cannot read and write	39	41.5
Read &w rite	23	24.5
Secondary education	25	26.6
University education	7	7.4
Marital status		
Single	17	18.1
Married	70	74.4
Widow	6	6.4
Divorced	1	1.1
Occupation		
Employee	1	1.1
Handcraft	33	35.1
Does not work /Retired	60	63.8
Work type (N=34)		
Requires mental effort	1	2.9
Requires effort	33	97.1
Income		
Sufficient	16	17
Insufficient	78	83
Residence		
Rural	86	91.5
Urban	8	8.5
Smoking habit		
Yes	22	23.4
No	72	76.6
Cigarette number (N=22)		
10 per day	9	40.9
20 per day	8	36.4
30 per day	5	22.7
Years of smoking (N=22)		
< 5 years	15	68.2
6-10 years	4	18.2
>10 years	3	13.6
Home care provider		
Yes	39	41.5
No	55	58.5

Table (2): Comparison of patients' knowledge about HCV and its therapeutic regimen pre-and post-implementation of educational guidelines (n=94).

Knowledge elements	Pre educational guidelines		Post educational guidelines		X^2	P-value
	No	%	No	%		
Hepatitis C virus						
Un satisfactory	82	87.2	7	7.4	120.02	0.000
Satisfactory	12	12.8	87	92.6		
HCV therapeutic regimen						
Un satisfactory	94	100	39	41.5	77.74	0.000
Satisfactory	0	0	55	58.5		
Pharmacological treatment						
Un satisfactory	94	100	35	37.2	85.98	0.000
Satisfactory	0	0	59	62.8		
Appropriate diet & fluid						
Un satisfactory	94	100	35	37.2	85.98	0.000
Satisfactory	0	0	59	62.8		
Daily activity						
Un satisfactory	94	100	75	79.8	21.13	0.000
Satisfactory	0	0	19	20.2		
Follow up						
Un satisfactory	94	100	0	0	180.22	0.000
Satisfactory	0	0	94	100		
Measures required to reduce medication side effects						
Un satisfactory	94	100	90	95.7	4.08	0.061
Satisfactory	0	0	4	1.3		
Total knowledge						
Un satisfactory	91	96.8	38	40.4	69.38	0.000
Satisfactory	3	3.2	56	59.6		

Table (3): Comparison of patient's level of adherence pre- and post-implementation of educational guidelines (n=94).

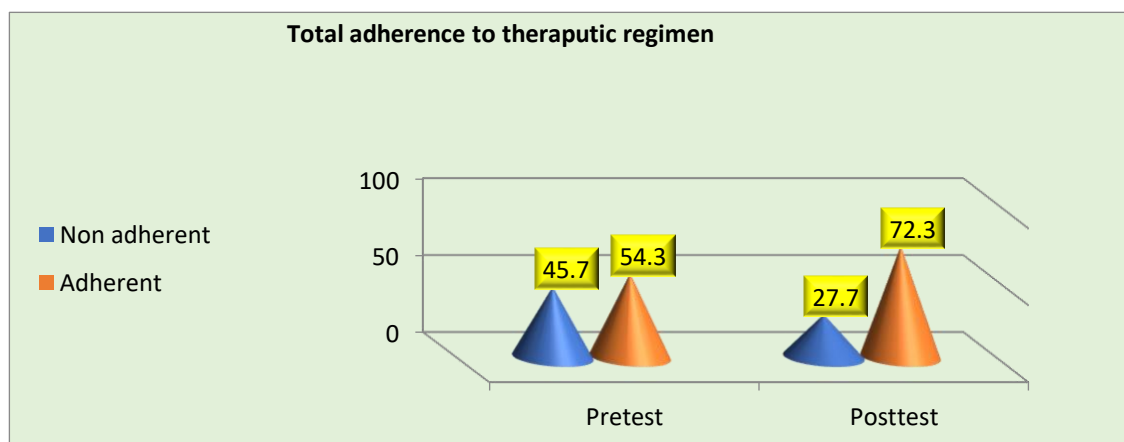| Adherence variables	Pre educational guideline		Post educational guideline		X^2	P-value
	No	%	No	%		
Medication						
Non-adherent	55	58.5	33	35.1	10.34	0.001
Adherent	39	41.5	61	64.9		
Diet						
Non-adherent	89	94.7	25	26.6	91.28	0.000
Adherent	5	5.3	69	73.4		
Daily activity						
Non-adherent	85	90.4	74	78.7	26.52	0.000
Adherent	9	9.6	20	21.3		
Follow up						
Non-adherent	4	4.3	2	2.1	0.68	0.341
Adherent	90	95.7	92	97.9		

Figure (1): Percentage distribution of patients' total level of adherence pre- and post-implementation of educational guidelines.

Table (4): Relation between patients' total knowledge and patients' total level of adherence pre- and post-implementation of educational guidelines (n=94).

Adherence	Total knowledge levels							
	Pretest				Posttest			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	No	%	No	%	No	%	No	%
Medication								
Non-adherent	70	37.2	18	9.6	13	13.8	15	16
Adherent	59	31.4	41	21.8	27	28.7	39	41.5
Significance	X^2=0.24, *p*=0.39				X^2=9.17, *p*=0.002			
Diet								
Non-adherent	100	53.3	14	7.4	9	9.6	16	17
Adherent	29	15.4	45	23.9	31	33	38	40.4
Significance	X^2=0.59, *p*=0.29				X^2=49.07, *p*=0.000			
Daily activity								
Non-adherent	103	54.8	36	19.1	24	25.5	30	31.9
Adherent	26	13.9	23	12.2	16	17	24	25.5
Significance	X^2=0.18, *p*=0.41				X^2=7.44, *p*=0.006			
Follow up								
Non-adherent	4	2.1	2	1.1	1	1.1	1	1.1
Adherent	125	66.5	57	30.3	39	41.5	53	56.4
Significance	X^2=0.46, *p*=0.67				X^2=0.01, *p*=0.61			

Regarding the total level of adherence to the therapeutic regimen, the present study shows that more than half of the patients under study adhered to the therapeutic regimen pre-implementation of educational guidelines vrsus nearly three-quarters post-educational guideline implementation. This finding could be attributed to the effectiveness of conducting the educational guideline that positively affects patient adherence post-implementation of the educational guideline. This finding agrees with *Hamzway et al. (2019)*, who stated that total behavioral therapeutic regimen adherence was observed in two-thirds of the study subjects.

Concerning medication adherence, the current study reveals a statistically significant difference between total adherence to medication pre-and post-implementation of educational guidelines. The level of adherence was improved from two-fifths of the studied patients to around two-thirds. This improvement may be attributed to patients receiving support by phone during the implementation of educational guidelines to avoid the missed dose and overcome forgetfulness. In addition, educational guidelines the patients received improved their awareness about the importance of adhering to medication. This finding agreed with the literature of *Williams (2017),* who indicated that nursing interventions could assist in improving medication adherence.

By investigating adherence to diet, the current study's finding reveals that a few patients adhered to appropriate diet pre-educational guidelines. This result may be due to a lack of awareness about appropriate diet due to insufficient medical counseling from the health care providers. Conversely, the current study shows that nearly three-quarters of the studied patients adhered to the appropriate diet post-implementation of educational guidelines, with a statistically significant difference between the two study phases. This noticeable improvement in adherence level to diet post implementation of the educational guideline may be due to the high level of response from patients to educational guidelines and the desire of patients to increase their tolerance and complete treatment.

This result was in the same line with *Abd El Rahman (2018)*, who mentioned that one-quarter of hepatitis C patients were committed to healthy food practices and attributed the result of his study to the poor educational level of the patients. The study is agreed with *El Roby (2017)* who clarified that most subjects complied with the dietary recommendations in a study that made nutritional assessment of patients with chronic hepatitis C treated with combination therapy. This result also agrees with *Gamaleldin et al. (2022)***,** who mentioned an improvement in the adherence level to diet by three-quarters of patients post-educational guideline implementation.

Concerning adherence to daily activity, the current study shows a slight increase in patients' adherence to daily activity post-implementation of the educational guideline, where only one-fifth of studied patients adhere to daily activity post-educational guideline compared to a few of the patients' pre-educational guideline implementation. This finding may be because most patients reported that no one informed them about the needed activity. In addition, around two-thirds of patients reported that they could not do the daily activity because of fatigue or lack of support from a caregiver at home. This study shows that more than half of the patients had no home care providers.

In the same line with the current study, *Soliman, et al. (2021)* mentioned a decrease in the ability to perform activities of daily living was observed during HCV treatment, this disruption in performing the daily activity and impaired quality of life was attributed to chronic physical and psychological symptoms related to HCV and side effect from antiviral medication in a study that assesses the effect of direct-acting antiviral treatment on daily living activities for patients with hepatitis C virus. Also*, El-Gendi (2018)* highlights that the negative role of family members was

negatively impacted on fatigue and daily activity of patients with HCV.

Concerning adherence to following up, the current result clarified that most patients adhered to follow-up pre-and post-implementation of educational guidelines. This finding might be attributed to the current study's setting of providing patient follow-up care, including attendance days. In addition, patients are contacted by phone by the treatment unit or the researcher in the case of absence from follow-up.

This study is supported by *Hamzway et al. (2019),* who showed that nearly two-thirds of participants adhere to follow-up in a study about therapeutic regimen adherence among the elderly diagnosed with chronic hepatitis C virus.

Concerning the relation between patients' total knowledge and patients' total level of adherence pre and post-implementation of the educational guidelines. The current study clarifies a statistically significant relationship between patients' total knowledge level and patients' total level of adherence regarding medication, diet, and daily activities post-implementation of educational guidelines. At the same time, there was no relation between these variables in the pre-implementation of educational guidelines. Adherent patients get a higher satisfaction level of knowledge pre and post-implementation of educational guidelines with a non-significant relationship between the total level of knowledge and the follow-up in both phases. This finding reflects the success of the educational guideline in improving the level of information and awareness of patients, which creates positive enhancement to follow recommended behaviors that lead to an improvement in their adherence to the therapeutic regimen. This result supports the research hypothesis that implementation of the educational guidelines had a significant positive effect on the adherence of patients with viral hepatitis C toward oral therapeutic regimens.

This result agrees with *Kvarnstrom et al. (2021),* who reported that a good understanding of illness and its treatment is considered the critical facilitator for adherence to treatment in a study that assesses factors contributing to medication adherence in patients with a chronic condition. In addition to *Ahmed et al. (2021)* reported that educational interventions for patients with HCV are crucial to increase the adherence rate to the treatment, and health education should be multidisciplinary that cooperation between a hepatologist, family physician, and psychiatrist is needed for a good outcome.

7. Conclusion

The study concluded that implementing the educational guideline for patients with hepatitis C under new oral treatment has a statistically significant positive effect on improving patients' adherence to medication, diet, and daily activity. These findings support the current research hypothesis.

8. Recommendations

For patients:
- Design Arabic educational material (colored booklet) about HCV and management needed during treatment, and it should be given to every patient.
- Close involvement of the patients and their families in decision-making about disease management to improve patient adherence.

In Services:
- Continuing in-service training programs for all healthcare providers on providing multidisciplinary support to HCV patients under new oral treatment therapy.
- Establishment of a hotline contact to support patients for urgent and non–urgent consultation to overcome non-adherence to new oral hepatitis C virus therapeutic regimen.
- Publishing posters containing management needed during new oral hepatitis C virus treatment in all different health care settings.

In research:
- Replication of the research study on a large probability sample is recommended to achieve generalization of the results.
- Further research is recommended to study factors affecting patients' adherence to new oral hepatitis C virus therapeutic regimens.

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