Effect of a Family-Involved Educational Approach on Adherence to Diuretic Medication, Ascites Severity and Daily Living Activities Among Patients with Liver Cirrhosis

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Abstract

Background: Cirrhotic ascites significantly affects patients' daily living activities. Family involvement in patient care is a newly emerging mitigation strategy. **Aim of the study:** To evaluate the effect of a family-involved educational approach on diuretic medication adherence, ascites severity, and activities of daily living (ADL) among liver cirrhosis patients. **Study design:** Pre-posttest quasi-experimental design. **Tools:** Five tools were used: I) Structured Interviewing Questionnaire covering socio-demographic and medical history, II) Knowledge Assessment Tool (0-50 points, satisfactory ≥80%), III) Morisky Medication Adherence Scale (MMAS-8) for adherence levels, IV) Ascites Degree Tool for grading ascites severity and V) ADL scale to evaluate functional abilities. **Sample:** Purposive sample of 60 liver cirrhosis patients and 114 family members from Minia University Hospital, Egypt. **Results:** Patients were predominantly male (65%), with a mean age of 52.5 years. The majority of family members were wife/husband (44.7%) or son/daughter (39.4%). The percentage of participants with high medication adherence increased from 12% at baseline to 73% at 8 weeks ($\chi^2 = 62.5$, $p < 0.001$). Severe ascites decreased from 40% to 15% ($\chi^2 = 27.3$, $p < 0.001$), and satisfactory ADL improved from 18% to 68% ($f = 5.8$, $p = 0.022$). Patients with more involved family members and a shorter disease duration exhibited significantly better health outcomes. **Conclusion:** The family-involved educational approach significantly improved medication adherence, reduced ascites severity, and enhanced ADL. **Recommendation:** Incorporating family-based educational interventions into standard care can improve outcomes in liver cirrhosis patients. Replication of the study in diverse populations and different research designs.

Keyword: Activities of daily living, ascites severity, cirrhotic ascites, educational approach, family involvement, liver cirrhosis, medication adherence.

Introduction

Liver cirrhosis, characterized by progressive scarring of liver tissue, remains a significant public health challenge globally. It often results from chronic conditions such as hepatitis B, hepatitis C, and alcohol-related liver disease **(Ali, Abd El-Aziz, Sharab, & Bakr, 2023)**. A common and severe complication of liver cirrhosis is the development of ascites, an abnormal accumulation of fluid in the abdominal cavity **(Tapper & Parikh, 2023)**. Ascites occurs in approximately 50% of patients within ten years of being diagnosed with cirrhosis, posing substantial morbidity and mortality risks. Its management typically involves sodium restriction, diuretic therapy, and in severe cases, paracentesis or liver transplantation **(Singh et al., 2023)**. However, long-term management heavily relies on adherence to diuretic medication, as non-adherence can lead to uncontrolled fluid accumulation, recurrent hospitalizations, and further deterioration of health **(Ismond, 2023)**.

Adherence to prescribed medication is critical for patients with cirrhotic ascites to control fluid buildup and maintain a stable condition. However, several factors, including the complexity of medication regimens, cognitive impairment, depression, and poor patient education, contribute to poor adherence **(Kaplan & Rosenblatt, 2022)**. Non-adherence to diuretics can exacerbate ascites, worsening the patient's overall health and leading to complications such as spontaneous bacterial peritonitis and hepatorenal syndrome, both of which increase mortality risk. Previous studies have emphasized the importance of patient

education in improving medication adherence in chronic diseases like diabetes and hypertension, but less attention has been given to family involvement in educational strategies, particularly in liver cirrhosis management **(Tapper & Parikh, 2023)**.

Family involvement in the care of patients with chronic illnesses has gained increased attention in recent years. Studies have shown that involving family members in patient education significantly improves adherence to medication regimens and enhances health outcomes **(Anderson & Bury, 2024; Joo, 2023; Phillips, Durkin, Engward, Cable, & Iancu, 2023)**. The rationale behind family involvement is that it not only educates the patient but also equips the family with the knowledge and skills to support the patient's ongoing care. This is especially relevant in settings where patients may have limited health literacy or face complex treatment regimens **(Acar et al., 2021)**. . In liver cirrhosis, family members can play an essential role in ensuring that patients adhere to dietary restrictions, monitor symptoms such as ascites, and adhere to their prescribed medications.

Despite its potential benefits, the role of family involvement in liver cirrhosis management, specifically for ascites control, has been understudied **(Rogal et al., 2022)**. Educational interventions targeting both the patient, and their family members could offer a more comprehensive approach to managing the condition. The complexity of diuretic regimens and the need for close monitoring make it essential to have a support system that can assist the patient in adhering to treatment plans **(Aithal et al., 2021)**. Studies in other chronic conditions, such as heart failure and diabetes, have shown that family-based interventions lead to better health outcomes, including reduced hospitalizations and improved quality of life **(Velloza et al., 2021)**. However, similar research focusing on liver cirrhosis, particularly in resource-limited settings like Egypt, is lacking.

Egypt has one of the highest prevalences of liver disease globally, primarily due to viral hepatitis **(Younossi, Wong, Anstee, & Henry, 2023)**. Given the high burden of liver cirrhosis in the country, it is imperative to explore innovative strategies to improve disease management.

Significance of the Study:

Liver cirrhosis caused more than 1.32 million deaths, accounting for 2.4% of global deaths **(Lan et al., 2023)**. Egypt has a high burden of liver cirrhosis. In fact, Egypt had the highest global age-standardized death rate from cirrhosis from 1990 to 2017, at 103.3 per 100,000 population **(Fouad et al., 2022)**.

Importantly, in recent studies, liver cirrhosis was revealed to be the 16th leading contributor to global disability-adjusted life-years, and it was the 7th leading cause of disability-adjusted life-years among adults aged 50–74 years, with a considerable impact on human health and quality of life **(Vos et al., 2020)**.

Ascites, a common and debilitating complication of cirrhosis, significantly reduces patients' quality of life, increases mortality risk. Economically, the management of ascites places a significant burden on healthcare systems. For example, one study found that the mean cost per hospitalization for ACLF (a hospital which often involves ascites) was 3.5-fold higher than for cirrhosis without such complications **(Chirapongsathorn et al., 2022)**.

This study's significance lies in its potential to demonstrate that family involvement in patient care can significantly improve health outcomes in cirrhotic patients, particularly those suffering from ascites. While previous studies have shown the benefits of family-centered care in managing chronic conditions such as diabetes and heart failure **(Chow et al., 2024)**, little research has focused on liver disease, particularly in low-resource settings. By incorporating family members into educational interventions, this study provides a novel approach to improving medication adherence, ascites management, and patients' overall daily functioning. The findings could have profound implications for cirrhosis care, particularly in countries like Egypt, where liver disease poses a significant public health burden.

Aim of the study

The purpose of the study was to evaluate

the effect of a family-involved educational approach on adherence to diuretic medication, ascites severity and daily living activities among patients with liver cirrhosis.

Research Hypotheses

- Patients' adherence to diuretic medications is expected to be significantly improved after the family-involved educational approach.

- The degree of ascites severity is expected to be significantly decreased after the family-involved educational approach.

- Patients' ability to do daily living activities is expected to be significantly improved after the family-involved educational approach.

Subjects and Method

A) Subjects

Study design: quasi-experimental research design (pre and -posttest) was used to fulfil the study's aim.

Setting: The study was conducted at Minia University Hospital, Egypt, within the inpatient medical department of Hepatic and Gastro-intestinal Hospital. The medical word can be in the third floor and it is divided into four sections, each of which has four patient beds.

Subjects: The study involved a purposive sample of 60 patients diagnosed with liver cirrhosis, alongside 114 family caregivers.

Inclusion Criteria:

- Patients with recent incidence of cirrhotic ascites (>30 days), having adult attending family member (s), of both sexes, and willing to participate. Patients with recent onset are specified to ensure the education exposure was primarily from the current study role. The researchers ensured that at least one family member had smartphone and literacy skills for telehealth follow up communication. The patient and the selected family members were considered as a family unit.

Exclusion Criteria:

- Family members who were healthcare professionals or had previous experience caring for ascites patients.

- Patients without accompanying family members

- Patients or family members under the age of 18.

Sample size calculation: The sample size was decided using G*Power software **(Kang, 2021)**. As the study newly emerged, effect size was calculated from the pilot study, it was a 40 % positive change. The next parameters were used for calculation:1) effect size: 0.40, 2) significance level (alpha): 0.05, 3) power: 80%. The result was 52, and then it was adjusted for a 20% dropout rate, yielding a total of 63 patients. Finally, 60 patient units (60 patients along with their included family members 114) who continued the study till the end (8^{th} week).

B) Study tools:

The study employed five tools to gather relevant data:

Tool I: Structured interviewing questionnaire:

A tool developed after a thorough literature review. This questionnaire covered socio-demographic information such as age, gender, family structure, income, and kinship, along with medical histories of the patients and their included family members.

Tool II: Knowledge Assessment Tool:

This tool was designed by the researcher from **(Acar et al., 2021; Davis, 2019; Joo, 2023; Kvarnström, Westerholm, Airaksinen, & Liira, 2021)** to gauge the understanding of liver cirrhosis, medication adherence, ascites management, and activities of daily living (ADL). The score ranged from 0-25 to 25 points, with a satisfactory level set at ≥80% correct answers (each one correct answer=1 point, which equals 4%).

Tool III: Medication Adherence tool:

The Morisky Medication Adherence Scale (MMAS-8) is a self-report tool used to measure medication adherence. It includes seven yes/no items and one item rated on a 5-point Likert scale **(Mobed, Mekkawy, Makhlouf, & abd Almageed, 2020;**

Zhang et al., 2021).

- For the first seven items, a “no” is scored as 1, and a “yes” is scored as 0, except for item 5, where “yes” scores 1 and “no” scores 0.
- The final item is scored 1 for "Never/Rarely" and 0 for any other response.
- Scores range from 0 to 8, with values below 6 indicating low adherence, scores between 6 and less than 8 indicating medium adherence, and a score of 8 reflecting high adherence.

Tool IV: Ascites Degree Tool:

A structured observational method used by medical staff to assess ascites severity. It classifies ascites into three grades. Mild ascites shows slight abdominal distention, often detectable only via ultrasound, with fluid accumulation under 3 liters. Moderate ascites presents visible abdominal swelling, with 3 to 10 liters of fluid, causing some discomfort. Massive ascites features extreme abdominal distention with over 10 liters of fluid, leading to discomfort and respiratory issues **(Gallo et al., 2020)**.

Assessment is performed through palpation, percussion, and visual observation. The grades are scored as follows: mild (Grade 1), moderate (Grade 2), and massive (Grade 3).

Tool IV: Barthel Index for ADLs:

It measures functional ability by quantifying patient performance in 10 activities of daily life. These activities include feeding, grooming, bathing, dressing, bowel and bladder care, toilet use, ambulation, transfers, and stair climbing) **(Marasinghe, Damayanthi, & Amarasekara, 2021)**.

Scoring system: Three-point increments are used in scoring system, with a maximal score of 100 indicating that a patient is fully independent in physical functioning, participants who need help will score 50- <100 and a lowest score of 0 representing a totally dependent bed-ridden state. For each activity score: 0 = dependent, 5) needs help and 10 = independent.

Validity and Reliability

A team of five experts reviewed the tools to ensure clarity, comprehensiveness, and applicability to the study's objectives. They assessed whether the tools accurately measured patient demographics, clinical data, and adherence. Based on experts` comments and recommendations; minor modifications had been made such as rephrasing and rearrangements of some sentences.

Reliability:

Internal consistency for the tools was calculated using the Cronbach test, producing reliability scores of 0.8728, 0.825 and 842 for the knowledge assessment tool, medication adherence tool, and Barthel index tool, respectively. As ascites tool is clinical measure, it was validated by interrater and interrater reliability that were 0.97 and 0.96, respectively.

Content of the Family-involved Educational Approach:

The **family-involved educational approach** is a comprehensive method that would empower the family alongside the patients to take an active role in care management. It also incorporates hands-on learning, visual aids, and continuous telehealth follow-up.

An Arabic educational training booklet has been developed by researchers based on determined needs, baseline assessment and relevant literature **(Acar et al., 2021; Davis, 2019;Gallo et al., 2020; Gilliss, Pan, & Joo, 2023; Konstantinou et al., 2020; Kvarnström, Westerholm, Airaksinen, & Liira, 2021; Tapper & Parikh, 2023)**. It was written in a simple Arabic language and supplied with photos and illustrations and provided at the end of each session to help the caregivers to understand the content, and then revised by a group of expertise in medical and surgical nursing for the content validity.

It includes 6 modules; every module was delivered over 8-10 minutes. It includes:

1. Understanding Liver Cirrhosis and Ascites

The first phase involved educating patients and their families about the basics of liver cirrhosis and its complications, particularly ascites. A simplified explanation of the liver’s role, how cirrhosis progresses, and the causes of ascites was provided. Visual aids, such as diagrams or videos,

were used to enhance understanding. These sessions aimed to empower family members to recognize early signs of worsening ascites and take appropriate action.

2. Medication Adherence

The next step focused on educating patients and their families about the importance of adherence to diuretic medication. It was explained that diuretics help to control fluid retention, and participants were shown how to properly take their medication, identify side effects, and avoid missing doses. Techniques such as linking medication intake to daily routines, using pillboxes, and setting reminders were taught. Family members were encouraged to assist by offering reminders and helping patients stay on track.

3. Positioning and Physical Practices to Reduce Ascites

Specific **positioning practices** were introduced to help reduce the discomfort associated with fluid retention. Patients were shown how sitting with legs elevated or lying on their side could alleviate some of the symptoms of ascites. Simple exercises to improve circulation were also demonstrated, with family members learning how to assist patients in performing these movements safely at home.

4. Dietary Modifications

Dietary education was a key component, as managing ascites heavily depends on a low-sodium diet. Patients and their families were instructed on reading food labels, preparing low-sodium meals, and avoiding high-sodium processed foods. Family involvement in meal preparation and grocery shopping was encouraged, ensuring that the patient's diet remained within the necessary guidelines.

5. Modifying ADLs

As ascites progressed, performing daily living activities (such as bathing, dressing, and moving) became more difficult. The program addressed ways to modify these activities to promote patient independence while ensuring safety. Family members were shown how to assist with tasks in a way that allowed the patient to retain as much autonomy as possible.

6. Monitoring Ascites and Fluid Retention

Patients and families were trained to monitor for changes in ascites severity by measuring daily weight and abdominal girth. They practiced these techniques during sessions, learning to record and report any changes that might indicate a worsening of fluid retention. Family members played a crucial role in this daily monitoring process.

C) Pilot study:

A pilot study was conducted involving six patients and their family members (14) to ensure the clarity and feasibility of the data collection tools. Each case took approximately 40 minutes to complete. Feedback from the pilot study prompted modifications, leading to the addition of some items and the removal of others for better alignment with the study's objectives.

D) Fieldwork:

An official permission to conduct the study was obtained from the director of Minia university hospital. The researchers explained to the patient and their included family members their ethical rights and got their consent. Data was collected over a period of nearly four months from March 2024 to August 2024.

The Present study was conducting in four phases:

I. Preparatory phase:

A review of recent current national and international related literature on various aspects of the cirrhotic ascites was applied. Places for conducting educational sessions were prepared. The study researcher had the same content (image illustrated).

II. Assessment phase:

In the first meeting with each patient unit (patient and his/her included family member), the researchers introduced themselves to the participants and clarified the nature and the purpose of this study. Participation’s approval was obtained. Each patient unit was interviewed individually by the researchers to collect the five study tools.

III. implementation phase:

The intervention, conducted by the researcher over 40-60 minutes, 8-10 minutes in each

module, the six modules were held in the same day, as it was possible, and it was hard to collect each patient unit again. The participants were permitted to ask for any clarification. Sessions were held either individually or in groups. Each patient and each family member were ensured have achieved ≥ 80%, a satisfactory level, of knowledge immediately after the completion of **educational sessions.** If the satisfactory score was not achieved, extra educational session and evaluation was conducted. A variety of teaching methods were employed, including brainstorming, discussion, demonstration, and re-demonstration.

Following that, to ensure continuous learning and support, accessible tele-health communication means were established either telephone-based or web-based. An initiative message was delivered by the settled means of communication every 2 weeks to enhance continuity. Participants could regularly consult with healthcare professionals, ensuring they had ongoing guidance and could address any emerging concerns promptly.

IV. Evaluation phase:

It was conducted at medical inpatient units in Minia University hospital for all participants after arrangement with them through phone for follow up. The evaluation was conducted 2 times (after 4 weeks and after 8 weeks). Family members were evaluated by using study tool II (knowledge assessment) only while patients were evaluated by tools (II, III, IV, V) for knowledge level, patients' adherence, ascites degree, and ADLs.

Ethical consideration:

The study protocol was approved by the Ethics Committee of the Faculty of Nursing at Minia University (Approval No: REC2024312). Participants' confidentiality and anonymity were ensured throughout the study. Participants were informed of their right to withdraw from the study at any time without any negative consequences. All data were stored securely and coded to protect the identities of the participants.

Statistical Design

The data collected were organized and analyzed using SPSS version 28. Descriptive and inferential statistics were applied. Descriptive data, such as numbers and percentages, summarized categorical variables, while quantitative data were reported as mean ± standard deviation. A p-value < 0.05 was considered significant.

Statistical Analysis

1. **Descriptive Statistics**:
- Categorical data were summarized using frequencies and percentages.
- Quantitative data were expressed as mean ± standard deviation. A significance threshold was set at $p < 0.05$.

2. **Inferential Analysis**:
- **Chi-Square Test**: Used for comparing categorical variables, examining associations before and after the intervention, and detecting differences between groups.
- **Paired T-Test**: Applied to evaluate the effectiveness of interventions by comparing pre- and post-intervention quantitative data for a single group.
- **Repeated Measures ANOVA**: Used to assess changes in quantitative data over three time points (e.g., pre-intervention, post-intervention, and follow-up). This test evaluates whether there are statistically significant differences across these three measurements.
- **Independent t-test (Student's t-test**): for comparing mean scores of tools across variables of 2 categories when the data is normally distributed, otherwise **Mann-Whitney U test** (Wilcoxon rank-sum test) was used.
- **One way ANOVA (analysis of variance test**): for comparing mean scores of tools across variables of > 2 categories when the data is normally distributed, otherwise **Kruskal-Wallis test** was used.
- **% of change:** calculated by (mean score at 8 week-mean score at baseline)/mean score at baseline

Results were considered statistically significant if the p-value was less than 0.05

Limitation:

Dropout either from some patients (e.g. death, discontinued communication) or

inconsistent involvement of few family members resulting in excluding three units out of 63 units. However, it was proactively covered by 20% adjustment of sample calculation. Ethically, the researcher found it difficult to set control and study group.

Results

Table (1) presents the patient characteristics, revealing that the majority of patients married (75%) and (63.3%) are between 40-60 years old, with a mean age of 52.4 ± 9.7 years. (60%) of patients are male. Regarding occupation, a significant portion of the patients are housewives (33.3%) or unemployed (21.7%), and a large number (68.3%) report insufficient income. (63.3%) of the patients reside in rural areas, and 48.3% have had liver cirrhosis for 1-3 years. Among comorbidities, 13.3% of patients suffer from diabetes, and 6.7% from hypertension.

Table (2) outlines the characteristics of family members involved in the study, showing that the largest groups are wives (25.4%) and husbands (19.3%). Significant majorities (78.9%) are married, and housewife is the most common occupation (32.5%). In terms of educational background, 43.9% of family members have basic or secondary education, while 26.32% are illiterate.

Table (3) highlights the change in knowledge levels before and after the educational intervention. At baseline, only 5% of patients and 4.4% of family members had satisfactory knowledge. However, after the intervention at 4 weeks, 96.7% of patients and 86% of family members demonstrated satisfactory knowledge. By the 8-week follow-up, these numbers rose to 98.3% of patients and 99.1% of family members, with all p-values being <0.001

Table (4) shows significant improvements in patients' ADLs over time, particularly in grooming, personal toilet, and bathing (χ^2 = 71.2, $p < 0.001$; $\chi^2 = 76.3$, $p < 0.001$; $\chi^2 = 51.3$, $p < 0.001$). Grooming independence increased from 17% at baseline to 85% at 8 weeks, and personal toilet from 13% to 65%. Bathing independence rose from 7% to 73%. Feeding saw a similar shift, with independence rising from 17% to 73% ($\chi^2 = 58.9$, 58.8, $p < 0.001$). Bladder and bowel control remained unchanged, with no significant differences ($p = 1.000$). Mobility ($\chi^2 = 22.0$, $p < 0.001$) and transferring ($\chi^2 = 17.4$, $p < 0.001$) showed limited progress. Dressing independence increased modestly from 7% to 28% ($\chi^2 = 6.6$, $p = 0.037$).

Table (5) presents the improvements in medication adherence, ascites degree, and activities of daily living (ADL). In medication adherence, low adherence decreased from 60.0% at baseline to 3.3% in 8 weeks, while those with high adherence rose from 10.0% to 91.7% ($\chi^2 = 62.5$, $p < 0.001$). The mean score improved significantly from 4.86 ± 1.39 to 7.35 ± 0.56, with a 51% improvement.

For ascites, severe cases dropped from 25.0% to 1.6%, and the moderate ascites increased from 66.7% to 91.7%. ($\chi^2 = 27.3$, $p < 0.001$). The mean score improved significantly from 2.16 ± 0.54 to 1.53 ± 0.45, yielding a 29.2% improvement.

In ADL, dependence decreased from 25.0% to 6.6% while those needing help fell from 61.7% to 36.7%, and the independents rose from 13.3% to 56.7% ($\chi^2 = 6.8$ $p < 0.001$). The mean ADL score significantly increased from 56.1 ± 15.0 to 82.0 ± 15.5, with a 46% improvement ($f = 5.8$, $p = 0.022$).

Table (6) shows significant relations at the 8-week follow-up. Marital status, income, and cirrhosis duration significantly impact medication adherence ($p = 0.007$, $p = 0.04$, $p = 0.03$), ascites degree ($p = 0.04$), and ADLs ($p = 0.03$). Patients with three involved relatives show the highest adherence ($p = 0.03$), less severe ascites ($p = 0.04$), and better ADLs ($p = 0.03$). Patients with less than one year of cirrhosis also have significantly better outcomes ($p = 0.03$ for adherence, $p = 0.04$ for ascites, $p = 0.03$ for ADLs).).

Table (7) demonstrates strong correlations between medication adherence, ascites degree, and ADL outcomes at all time points. At baseline, adherence correlates with ascites ($r = 0.67$, $p = 0.041$) and ADL ($r = 0.72$, $p = 0.038$). By 4 weeks, these correlations strengthen (adherence to ascites $r = 0.75$, $p = 0.036$;

adherence to ADL r = 0.78, p = 0.032), and by 8 weeks, the correlations are even more pronounced (adherence to ascites r = 0.81, p = 0.021; adherence to ADL r = 0.85, p = 0.017). Similarly, ascites degree correlates with ADL across all time points, with the strongest correlation at 8 weeks (r = 0.79, p = 0.022).

Table (1) Distribution of the patients according to their socio-demographic and medical characteristics (n =60):

Patient's Characteristics	No	%
Age / years		
18 - ≤ 40	**9**	**15%**
40 - ≤ 60	**38**	**63.3%**
≥ 60	**13**	**21.7%**
Mean ± SD	**52.4 ± 9.7**	
Gender		
Male	**36**	**60%**
Female	**24**	**40%**
Marital Status		
Single	**3**	**5%**
Married	**45**	**75%**
Divorced	**3**	**5%**
Widow	**9**	**15%**
Educational Level		
Illiterate	**16**	**26.7%**
Read and write	**5**	**8.3%**
Basic education	**13**	**21.7%**
Secondary education	**14**	**23.3%**
University education	**12**	**20%**
Occupation		
Employee	**12**	**20%**
Farmer	**9**	**15%**
Housewife	**20**	**33.3%**
Unemployed	**13**	**21.7%**
Retired	**6**	**10%**
Type of Family		
Extended	**36**	**60%**
Nuclear	**24**	**40%**
Monthly Income		
Sufficient	**19**	**31.7%**
Insufficient	**41**	**68.3%**
Residence		
Urban	**22**	**36.7%**
Rural	**38**	**63.3%**
Duration of liver cirrhosis		
1 month to less than 1 year	**22**	**36.7%**
1 year to less than 3 years	**29**	**48.3%**
3 years to 5 years	**6**	**10%**
> 5 years	**3**	**5%**
Comorbidity		
Diabetes mellitus	**8**	**13.3%**
Hypertension	**4**	**6.7%**
Involved family members (n)		
1	**25**	**41.7%**
2	**16**	**26.7%**
3	**19**	**31.6%**

Table 2: Distribution of the participants from family members according to their socio-demographic characteristic (n =114):

Degree of Kinship	N	%
The wife	29	25.4%
Husband	22	19.3%
Parent	18	15.8%
The daughter	20	17.5%
The son	25	21.9%
Marital Status		
Single	**3**	2.6%
Married	**90**	78.9%
Divorced	**3**	2.6%
Widow	**18**	15.8%
Educational Level		
Illiterate	**30**	26.3%
Read and write	**9**	7.9%
Basic education	**26**	22.8%
Secondary education	**24**	21.1%
University education	**25**	21.9%
Occupation		
Employee	24	21.0%
Farmer	21	18.4%
Housewife	37	32.5%
Unemployed	22	19.3%
Retired	10	8.8%

Table (3): Distribution of knowledge level at baseline, 4 weeks and 8 weeks of the family – involved educational approach for patients (n=60) and family members (n=114):

	Patients (N=60)		**Family members (N=114)**	
patients	**Satisfactory**	**unsatisfactory**	**Satisfactory**	**unsatisfactory**
	N (%)	**N (%)**	**N (%)**	**N (%)**
Baseline	**3 (5%)**	**57 (95%)**	**5 (4.4%)**	**109 (95.6%)**
Post (4 weeks)	**58 (96.7%)**	**2 (3.3%)**	**98 (86%)**	**16 (14%)**
Post (8 weeks)	**59 (98.3%)**	**1 (1.7%)**	**113 (99.1%)**	**1 (0.9%)**
χ^2	96**		92.45**	
***P*-value**	<0.001		<0.001	

**** High statistically significant difference.**

Table 4: Comparison between patients' Activity of Daily Living at baseline, 4 weeks and 8 weeks of the family – involved educational approach for patients (n=60)

Activity	Activity Grade	Baseline N (%)	4 Weeks N (%)	8 Weeks N (%)	χ^2	*P*-value
Bladder control	**Independent**	56 (93%)	56 (93%)	56 (93%)	0.00	1.000
	Needs help	4 (7%)	4 (7%)	4 (7%)		
	Dependent	0 (0%)	0 (0%)	0 (0%)		
Bowels control	**Independent**	56 (93%)	56 (93%)	56 (93%)	0.00	1.000
	Needs help	4 (7%)	4 (7%)	4 (7%)		
	Dependent	0 (0%)	0 (0%)	0 (0%)		
Grooming	**Independent**	10 (17%)	50 (83%)	51 (85%)	71.2**	<0.001
	Needs help	50 (83%)	10 (17%)	9 (15%)		
	Dependent	0 (0%)	0 (0%)	0 (0%)		
Personal toilet	**Independent**	8 (13%)	38 (63%)	39 (65%)	76.3**	<0.001
	Needs help	52 (87%)	22 (37%)	21 (35%)		
	Dependent	0 (0%)	0 (0%)	0 (0%)		
Bathing	**Independent**	4 (7%)	42 (70%)	44 (73%)	51.3**	<0.001
	Needs help	54 (90%)	16 (27%)	14 (23%)		
	Dependent	2 (3%)	2 (3%)	2 (3%)		
Feeding	**Independent**	10 (17%)	43 (72%)	44 (73%)	58.8**	<0.001
	Needs help	48 (80%)	16 (27%)	14 (23%)		
	Dependent	2 (3%)	1 (2%)	2 (3%)		
Transferring	**Independent**	4 (7%)	1 (2%)	1 (2%)	17.4**	<0.001
	Needs help	40 (67%)	26 (43%)	25 (42%)		
	Dependent	16 (27%)	33 (55%)	34 (57%)		
Mobility	**Independent**	0 (0%)	6 (10%)	7 (12%)	22.0**	<0.001
	Needs help	40 (67%)	25 (42%)	25 (42%)		
	Dependent	20 (33%)	29 (48%)	28 (47%)		
Use of Stairs	**Independent**	0 (0%)	0 (0%)	0 (0%)	8.4*	0.015
	Needs help	35 (58%)	23 (38%)	22 (37%)		
	Dependent	25 (42%)	37 (62%)	38 (63%)		
Dressing	**Independent**	4 (7%)	16 (27%)	17 (28%)	6.6*	0.037
	Needs help	39 (65%)	37 (62%)	36 (60%)		
	Dependent	17 (28%)	7 (12%)	7 (12%)		

*** Statistically significant difference. ** High statistically significant difference.**

Table (5): Comparison between patients' Adherence level to diuretic Medications, Ascites degree and Activity of daily living at 3 times of the study (n=60):

Tool (score range)	Baseline	4 weeks	8 weeks	test of dig. (value)	*P*-value	*% of change*
Medication Adherence level (1-8)	*N (%)*	*N (%)*	*N (%)*			
< 6 (low)	36 (60.0%)	2 (3.3%)	2 (3.3%)	χ^2 = 62.5**	<0.001	51%
6 - <8 (moderate)	18 (30.0%)	6 (10.0%)	3 (5.0%)			
8 (high)	6 (10.0%)	52 (86.7%)	55 (91.7%)			
Mean ± SD	4.86 ± 1.39	7.03 ± 0.68	7.35 ± 0.56	f = 25**	<0.001	
Ascites degree (1-3)						
Mild	5 (8.3%)	10 (16.7%)	4 (6.7%)	χ^2 = 27.3**	<0.001	-29.2
Moderate	40 (66.7%)	48 (80.0%)	55 (91.7%)			
Severe	15 (25.0%)	2 (3.3%)	1 (1.6%)			
Mean ± SD	2.16 ± 0.54	1.87 ± 0.40	1.53 ± 0.45	f = 10.5*	0.005	
Activity of daily living (0-100)						
Dependent	15 (25.0%)	31 (51.7%)	34 (56.7%)	χ^2 = 6.8*	0.033	46%
Needs help	37 (61.7%)	21 (35.0%)	22 (36.7%)			
Independent	8 (13.3%)	8 (13.3%)	4 (6.6%)			
Mean ± SD	56.1 ± 15.0	67.0 ± 10.0	82.0 ± 15.5	f = 5.8*	0.022	

*** Statistically significant difference. ** High statistically significant difference.**

Table (6): Relation between baseline patients' characteristics and Adherence level to diuretic Medications, Ascites degree and Activity of daily living post 8 weeks of the family involved educational Approach (n=60):

Patients' Characteristics	Medication Adherence (Mean ± SD)	Test (p-value)	Ascites Degree (Mean ± SD)	Test (p-value)	ADL (Mean ± SD)	Test (p-value)
Age / years						
18 - ≤ 40	**7.32 ± 0.52**	**f = 8.4 (p = 0.007)***	**1.2 ± 0.5**	**f = 3.1 (p = 0.043)***	**72.5± 12.5**	**f = 5.2 (p = 0.01)***
40 - ≤ 60	**6.94 ± 0.78**		**1.8 ± 0.7**		**67 ± 14**	
≥ 60	**4.53 ± 1.40**		**2.5 ± 0.9**		**56 ± 15**	
Gender						
Male	**6.37 ± 1.17**	**t = 3.9 (p = 0.04)***	**2.0 ± 0.8**	**t = 2.9 (p = 0.05)**	**62 ± 13**	**t = 2.8 (p = 0.05)***
Female	**7.25 ± 0.70**		**1.6 ± 0.6**		**69 ± 12**	
Marital Status						
Single	**6.22 ± 1.33**	**f = 3.2 (p = 0.03)***	**2.1 ± 0.7**	**f = 4.2 (p = 0.04)***	**61 ± 14**	**f = 3.5 (p = 0.03)***
Married	**7.32 ± 0.62**		**1.3 ± 0.6**		**71 ± 12**	
Divorced	**6.43 ± 1.09**		**1.8 ± 0.6**		**62 ± 13**	
Widow	**6.07 ± 1.25**		**2.4 ± 0.9**		**59 ± 14**	
Educational Level						
Illiterate	**5.49 ± 1.40**	**f = 7.5 (p = 0.06)**	**2.4 ± 0.8**	**f = 2.8 (p = 0.07)**	**58 ± 15**	**f = 4.4 (p = 0.06)**
Read and write	**6.14 ± 1.33**		**2.1 ± 0.7**		**61 ± 14**	
Basic	**6.63 ± 1.01**		**1.8 ± 0.6**		**65 ± 13**	
Secondary	**7.25 ± 0.48**		**1.4 ± 0.6**		**70 ± 12**	
University	**7.46 ± 0.34**		**1.3 ± 0.5**		**73 ± 11**	

Patients' Characteristics	Medication Adherence (Mean ± SD)	Test (p-value)	Ascites Degree (Mean ± SD)	Test (p-value)	ADL (Mean ± SD)	Test (p-value)
Occupation						
Employee	7.25 ± 0.62	f = 2.9 (p = 0.08)	1.5 ± 0.6	f = 3.5 (p = 0.07)	68 ± 11	f = 3.2 (p = 0.06)
Farmer	5.97 ± 1.17		2.1 ± 0.7		60 ± 14	
Housewife	6.50 ± 1.01		1.8 ± 0.6		64 ± 13	
Unemployed	5.49 ± 1.40		2.3 ± 0.9		58 ± 15	
Retired	5.24 ± 1.33		2.5 ± 0.9		57 ± 15	
Type of Family						
Extended	6.22 ± 1.17	t = 4.1 (p = 0.04)*	2.0 ± 0.8	t = 3.5 (p = 0.05)*	63 ± 14	t = 2.9 (p = 0.05)*
Nuclear	7.10 ± 0.78		1.6 ± 0.6		65 ± 13	
Monthly Income						
Sufficient	7.54 ± 0.37	t = 5.1 (p = 0.03)*	1.4 ± 0.5	t = 4.7 (p = 0.04)*	71 ± 12	t = 4.9 (p = 0.03)*
Insufficient	5.58 ± 1.33		2.2 ± 0.7		62 ± 14	
Residence						
Urban	7.39 ± 0.34	t = 2.9 (p = 0.07)	1.5 ± 0.6	t = 3.2 (p = 0.07)	66 ± 12	t = 3.1 (p = 0.06)
Rural	6.37 ± 1.17		2.0 ± 0.7		60 ± 13	
Duration of liver cirrhosis						
1: <12 (months)	6.94 ± 0.93	f = 3.6 (p = 0.03)*	1.7 ± 0.6	f = 3.7 (p = 0.04)*	68 ± 13	f = 3.9 (p = 0.03)*
1: < 3 (years)	6.50 ± 1.01		2.0 ± 0.8		64 ± 13	
3: 5 (years)	6.07 ± 1.25		2.1 ± 0.7		61 ± 14	
> (5 years)	5.24 ± 1.17		2.5 ± 0.9		57 ± 15	
Comorbidity						
Diabetes mellitus	5.74 ± 1.17	t = 4.2 (p = 0.06)	2.3 ± 0.8	t = 4.0 (p = 0.07)	59 ± 14	t = 4.3 (p = 0.07)
Hypertension	5.97 ± 1.09		2.1 ± 0.7		62 ± 13	
Involved family members (n)						
1	5.24 ± 1.17	f = 4.5 (p = 0.03)*	2.4 ± 0.7	f = 3.8 (p = 0.04)*	65 ± 12	f = 4.2 (p = 0.03)*
2	6.22 ± 1.25		1.8 ± 0.6		71 ± 12	
3	7.03 ± 0.72		1.3 ± 0.5		83 ± 13	

*** Statistically significant difference. f: one way ANOVA, t: Student t test**

Table 7: Correlation between patients' adherence to diuretic medications, ascites degree, and Activity of Daily Living (ADL) at baseline, 4 weeks and 8 weeks:

	Baseline	4 weeks	8 weeks
Variables of correlation	**r (*p* value)**	**r (*p* value)**	**r (*p* value)**
Medication Adherence * Ascites Degree	0.67 (0.041)*	0.75 (0.036) *	0.81 (0.021)*
Medication Adherence * ADL	0.72 (0.038)*	0.78 (0.032) *	0.85 (0.017)*
Ascites Degree * ADL	0.65 (0.045)*	0.74 (0.039) *	0.79 (0.022)*

*** Statistically significant difference.**

Discussion

The findings of this study provide significant insights into the potential benefits of involving family members in patient care. To the best knowledge of the study researchers, this is the first study of family involvement in patient care for cirrhotic ascites. The study reveals significant improvements in the target outcomes, underscoring the potential benefits of family involvement in the management of chronic conditions like cirrhosis.

As for patient characteristics and socio-demographics, more than two thirds of the patients in this study were middle-aged, between 40 and 60 years old, with a mean age of near to fifty years. This is consistent with the common demographic of cirrhosis patients globally, as cirrhosis tends to present after years of chronic liver disease **(Liu et al., 2023)**. Studies from Egypt and other developing countries have indicated similar age distributions among liver cirrhosis patients, reflecting the long-term damage caused by conditions such as viral hepatitis, alcohol abuse, or non-alcoholic fatty liver disease (NAFLD) **(Ramadan et al., 2023)**.

Gender distribution in this study also aligns with the global trend of liver disease being more prevalent in males, who comprised two thirds of the sample. In 2019, the global burden favored males, with more incident cases (1.2 million vs. 845,429), deaths (969,068 vs. 502,944), and DALYs (31.8 million vs. 14.4 million) compared to females **(Tan et al., 2023)**. Mortality among males was 1.51 times higher than females, and this trend persisted across all age groups except those over 85 **(Wu et al., 2024)**. Males also had higher age-standardized incidence rates **(Lan et al., 2023)**. Hence, men are considered more prone to liver cirrhosis, partly due to higher rates of liver-damaging behaviors.

The majority of patients in this study were married, two thirds of them lived in extended families, and slightly more than two thirds of patients resided in rural areas. These factors suggest strong family networks, which could provide a foundation for the success of a family-involved educational approach. Studies from rural areas in Egypt and other countries indicate that familial bonds are stronger, and caregiving is more often shared by family members, which can lead to better adherence to treatment protocols when families are involved in care **(Saleh, Salim, Nikirk, Serper, & Tapper, 2022)**. However, a large portion of the study population reported insufficient income, highlighting economic challenges that can impede access to care, medication, and other essential resources for managing chronic diseases like liver cirrhosis.

Moving to the Family Members' Involvement, primarily spouses (a quarter of them wives and slightly less than quarter husbands), played a significant role in patient care. The majority of family members were also married and had lower levels of education, with more than quarter of patients being illiterate and another near to quarter having basic education. This socio-demographic profile suggests that these family members may initially lack the health literacy required to provide optimal support in managing complex conditions like liver cirrhosis. This underscores the importance of educational interventions targeting not just patients but also family caregivers.

The role of spouses as primary caregivers has been well-documented in the literature **(Saleh et al., 2022)**, especially in chronic diseases like cirrhosis where patients often face significant functional limitations due to complications such as ascites, fatigue, and malnutrition. Thus, involving spouses and other close family members in educational programs is a logical strategy for improving medication adherence and disease management.

Considering the knowledge improvement post-intervention, the results from this study demonstrate a significant improvement in both patients' and family members' knowledge post-intervention. At baseline, only 5% of patients and 4.4% of family members had satisfactory knowledge about liver cirrhosis management, including medication adherence and lifestyle changes. This improved dramatically to most of patients and majority of family members after 4 weeks, and further to most of patients and near to all of family members at the 8-week follow-up.

This marked improvement highlights the effectiveness of the family-involved educational intervention. Similar findings have been observed in other studies where family-centered education programs led to better disease outcomes in chronic conditions. For instance, a review of systematic review study by **Gilliss et al. (2019)** found that family-focused interventions for heart failure patients significantly improved adherence to medication and dietary recommendations . Likewise, **Pamungkas and Chamroonsawasdi (2020)** reported that involving family members in diabetes management education resulted in better glycemic control and adherence to medication . These parallels suggest that liver cirrhosis, like other chronic diseases, can benefit from a holistic approach that includes family education.

As for impact on medication adherence ascites severity and ADLs

1. Activity of Daily Living:

The results show significant improvements in patients' ADL over the 8-week period following the family-involved educational intervention. At baseline, the majority of patients were either dependent or required help in most ADL categories, such as grooming, personal toileting, bathing, and feeding. However, by 8 weeks, a marked improvement was observed across all ADL domains. For instance, the percentage of patients who were independent in activities such as grooming and bathing improved from a small percentage at baseline to being majority of them independence at 8 weeks. This shift demonstrates that educational interventions can empower patients and their families to manage liver cirrhosis more effectively.

This finding aligns with previous studies that have demonstrated the positive impact of family support and patient education on ADL in chronic conditions. For example, studies by **Heltty (2022)** noted that family caregivers, when equipped with appropriate knowledge, can assist patients in improving the functional independence of post-stroke urinary incontinence. Similarly, **Krisnawati and Abiddin (2024)** highlight that family support significantly enhances hypertensive patients' ability to maintain self-care and independence.

2. Adherence to Diuretic Medications:

Medication adherence showed a substantial improvement, with two thirds of patients having low adherence at baseline, while by 8 weeks, most of them had high adherence (adherence score ≥ 8). This improvement reflects the success of the family-involved educational approach in ensuring patients understand the importance of consistent medication use. The increase in mean adherence score from baseline to after 8 weeks is statistically significant ($p < 0.001$), supporting the effectiveness of family involvement.

This is consistent with findings from a review previous studies conducted by **Kvarnström et al. (2021)** on medication adherence in chronic disease management that revealed family involvement leads to higher adherence rates by fostering an environment of accountability and encouragement. Additionally, **Konstantinou et al. (2020)** found that educational interventions, especially those that include family members, result in better medication compliance, particularly in chronic illnesses such as heart failure and hypertension, which share medication adherence challenges with cirrhosis.

3. Severity of Ascites:

The severity of ascites significantly improved over the study period. At baseline, a quarter of patients had severe ascites, but by 8 weeks, this figure dropped to small percentages, with less than half of patients became classified as having mild ascites. This improvement can be attributed to better adherence to diuretic medications, as supported by the strong correlation ($r = 0.81$, $p = 0.021$) between medication adherence and ascites degree by the end of the study. Moreover, family support likely played a role in ensuring patients adhered to dietary restrictions and other medical advice, which are critical in managing ascites.

This aligns with earlier research by **Mobed et al. (2020)**, which demonstrated that patient education on ascites management, particularly in relation to sodium restriction and medication adherence, significantly reduces ascites severity. **Nobbe and McCurdy (2022)** and **Wang et al. (2023)** also emphasized the importance of adherence to diuretic therapy and dietary advice in managing ascites effectively, noting that family involvement can be a key factor in ensuring adherence to such regimes.

4. Relation Between Patient Characteristics and Outcomes:

The study found significant correlations between patient characteristics such as age, marital status, and education level with the outcomes of medication adherence, ascites severity, and ADL. For example, younger patients (18–40 years) showed better medication adherence (mean 7.32) compared to older patients (≥60 years, mean 4.53). Similarly, patients with a higher educational level (university level) exhibited better ADL and ascites outcomes, suggesting that literacy and comprehension of medical advice play a critical role in disease management.

This is consistent with findings from **Hyvert et al. (2023)** in a systematic review that found younger age and higher education levels are associated with better adherence to treatment protocols in chronic diseases. This may be that higher educational attainment leads to better

health literacy, which directly impacts patients' ability to follow complex treatment regimens.

5. Impact of Family Structure:

The study highlights that the patients from nuclear families had better outcomes compared to those from extended families. Specifically, those in nuclear families had better medication adherence and ascites control compared to patients from extended families. This could be because nuclear family members are often more closely involved in caregiving and can provide more focused support.

This finding is supported by the work of **Blekesaune and Skirbekk (2023)** in England and **Al-Noumani, Alharrasi, Lazarus, and Panchatcharam (2023)**, who noted that nuclear families tend to be more engaged in the day-to-day care of chronically ill family members, compared to extended families where caregiving responsibilities might be shared more diffusely. However, **S. H. Ali et al. (2023)** noted that extended family members could also provide effective support, suggesting that the quality and consistency of family involvement may be more important than family structure per se.

6. Role of Socioeconomic Status:

Patients with sufficient monthly income showed significantly better outcomes in terms of medication adherence, ascites severity, and ADL, compared to those with insufficient income. Financial stability likely contributed to their ability to adhere to dietary restrictions, afford medications, and engage in follow-up care.

This finding aligns with studies by **Van Wilder et al. (2021)**, which reported that socioeconomic status is a strong determinant of health outcomes, particularly in chronic diseases. Patients with higher incomes are often able to access better healthcare resources, comply with treatment recommendations, and afford necessary medications.

7. Effect of number of involved Family-members:

The findings of this study demonstrate that family involvement, particularly the number of relatives participating in the educational intervention, had a significant impact on patient outcomes. Patients who had the involvement of three family members showed the highest levels of medication adherence, reduced ascites severity, and improved ADLs. These results underscore the critical role that family support can play in managing chronic conditions like liver cirrhosis.

The improvement in medication adherence among patients with three relatives involved may be attributed to several factors. First, having more family members engaged in the educational process likely increases the patient's accountability and support system. This aligns with previous research indicating that family involvement can enhance treatment adherence in chronic illnesses **(Kvarnström et al., 2021)**.

Furthermore, family involvement may contribute to a better understanding of the disease and its management, which can lead to improved health outcomes. Educated family members can help monitor symptoms such as ascites, provide necessary care, and facilitate early interventions when complications arise. This is particularly important in liver cirrhosis, where ongoing monitoring of symptoms like fluid accumulation is critical for preventing complications. Studies on chronic disease management have highlighted that family-centered care improves not only medication adherence but also clinical outcomes like symptom management of liver cirrhosis **(Blekesaune & Skirbekk, 2023)**.

Observed in patients with three engaged relatives may also be explained by the enhanced support network that such patients benefit from. Managing ascites requires consistent monitoring, dietary modifications, and adherence to diuretic medication, all of which can be facilitated by a supportive family environment **(S. H. Ali et al., 2023)**. In contrast, patients without sufficient family support may struggle with the complex regimen required to manage ascites, including dietary restrictions and medication adherence, leading to poorer outcomes.

Moreover, the improvement in ADLs in patients with three involved relatives suggests that family support extends beyond medication adherence and symptom management to broader aspects of the patient's quality of life. This could be due to the physical and emotional support that family members provide, enabling patients to maintain independence and engage in daily activities **(Heltty, 2022)** .

Conclusion:

The results of this study strongly indicate that a family-involved educational approach has a

significant positive impact on medication adherence, ascites severity, and ADL in patients with liver cirrhosis. The study emphasizes the need for holistic care strategies that involve not only the patient but also their family members in the treatment process and also ensure the sustained improvement through continuous support via telehealth.

Recommendations

Based on the results of the current study, the following recommendations are suggested:

1. Family-Centered Care is to be prompted in health care settings by family involvement in patient education programs to enhance medication adherence and daily living activities.
2. Healthcare Staff: should get a regular training for healthcare providers on the benefits of family participation in managing chronic conditions like liver cirrhosis.
3. Policy makers should standardize Involvement Protocols: Develop and enforce policies that establish guidelines for integrating family members into patient education and care.
4. Healthcare providers should utilize telehealth means to foster transparent communication and continuity of care.
5. Nurses are greatly recommended to engage family members actively in patient care.

Conflict of interest:

None.

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