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# Healthy Lifestyle among Type 2 Diabetic Patients with Non-Alcoholic Fatty Liver at Assiut University Hospital

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## Abstract
**Background:** Type 2 Diabetes Mellitus and Non-Alcoholic Fatty Liver Disease are interconnected chronic conditions that pose substantial challenges to global public health. **Aim of the study:** To assess the healthy lifestyle among Type 2 Diabetic patients with non-alcoholic fatty liver. **Research design:** A descriptive research design was utilized to conduct this study which was conducted in the Diabetic Center at the Main Assiut University hospital. **Sample:** A simple random sample of 408patients who are followed up in the Diabetic Center. **Tools:** Interview questionnaire which included personal characteristics, Health-Promoting Lifestyle Profile II questionnaire, Quality of life assessment scale and knowledge about Nonalcoholic fatty liver disease. **Result:** less than one third (31.4%) of patients were in the 50-60 years age group, 55.6% of them were female, 41.7% of them Class I Obesity. The knowledge mean score was (M= 13.25, SD=5.28), Health Promoting Lifestyle was(M= 146.84, SD=27.06) and Quality of life assessment scale was(M= 82.41, SD= 11.42). **Conclusion:** The study concludes that there are low knowledge level, Health Promoting Lifestyle was low in physical activity subdomain and low in social domain in Quality of life. There are socio-demographic factors significantly influence patients' knowledge about Nonalcoholic fatty liver disease, adoption of health-promoting lifestyles, and Quality of life. **Recommendation:** Nursing educational program for patients with Nonalcoholic fatty liver disease should be applied periodically to improve knowledge, promoting health Lifestyle and improving their quality of life.

***Keywords**: Healthy Lifestyle, Non-Alcoholic Fatty Liver & Type 2 Diabetic Patients.*

## Introduction
Non-alcoholic fatty liver disease (NAFLD) is one of the most common chronic liver diseases globally, representing a significant public health concern and imposing a substantial economic burden **(Manikat et al., 2024).**It is the most common liver disorder in Western countries, with a prevalence of 17–46% among adults and 31% in the Middle East **(Papatheodorid et al., 2023).** The coexistence of NAFLD and type 2 diabetes mellitus (T2DM) significantly increases the risk of diabetes-related complications, including both macrovascular and microvascular issues. Lifestyle modification and improving quality of life remain essential components of NAFLD management **(Ali et al., 2022).**

Non-alcoholic fatty liver disease is highly prevalent in individuals with T2DM due to shared pathophysiological mechanisms such as insulin resistance, obesity, and dyslipidemia. Insulin resistance, a hallmark of T2DM, promotes fat deposition in the liver by increasing lipogenesis and reducing lipid oxidation. On the other hand, NAFLD can worsen insulin resistance through chronic low-grade inflammation, leading to poor glycemic control and heightened risk of diabetes complications **(WHO, 2023)**.

Furthermore, individuals with T2DM are at a higher risk of progression from simple steatosis to more severe liver conditions, such as non-alcoholic steatohepatitis (NASH), fibrosis, and even cirrhosis. Effective management of both conditions involves a combination of lifestyle modifications, glycemic control, and weight loss, emphasizing the importance of an integrated approach to prevent adverse outcomes **(WHO, 2023).**

Unhealthy lifestyle and quality of life a common and crucial modifiable risk factor, has been proven to be independently related to many chronic non communicable diseases, such as type 2 diabetes, cancer and cardiovascular disease **(Zhang et al., 2021)**. Health lifestyle interventions are crucial for managing type 2 diabetes (T2D) in patients with nonalcoholic fatty liver disease (NAFLD). The interplay between these conditions necessitates a comprehensive approach that includes dietary modifications and regular physical activity **(Targher et al., 2021)**.

Weight loss plays a pivotal role in managing NAFLD, with even a 3% reduction being sufficient to decrease

liver fat, while a weight loss of 7–10% can improve steatohepatitis and hepatic fibrosis. A healthy diet, particularly one that avoids excessive fats and carbohydrates, combined with regular exercise, is the most recommended lifestyle change for patients with NAFLD **(Beygi et al., 2024).**

Patients with NAFLD require comprehensive education and ongoing support as part of their treatment. Nursing follow-up is crucial for promoting healthy behaviors and achieving better health outcomes. Regular and frequent follow-ups provide opportunities to intervene and foster behavior change **(Rucker, 2024).** Community health nurses play a pivotal role in this regard, as they can enhance patient awareness about NAFLD and its treatment. Through proper education on dieting, weight loss, increased physical activity, and continuous follow-up, nurses help prevent complications and improve treatment outcomes. Counseling services and tailored training sessions further empower patients with NAFLD to adopt healthier behaviors **(Mundi et al., 2020).**

## Significance of Study

Non-alcoholic Fatty Liver Disease is associated with an elevated risk of multisystem diseases, including cardiovascular events, metabolic disorders, and kidney complications, due to its impact on extra-hepatic organs and regulatory pathways **(Powell et al., 2021).** Urbanization and industrialization have further exacerbated the Non-alcoholic Fatty Liver Disease epidemic, with lifestyle changes being a significant contributing factor, particularly in the Asia-Pacific region **(Méndez-Sánchez et al., 2024).**

The global incidence of NAFLD is estimated at 47 cases per 1,000 people, with a higher prevalence in males (40%) compared to females (26%). The overall global prevalence among adults is approximately 32%. In Egypt, the rising prevalence of obesity has contributed to increasing NAFLD rates, in study conducted on adult Egyptian persons visiting the outpatient clinic or admitted in Department of Internal Medicine, Ain Shams University Hospitals, NAFLD was found in 57.65% of a cohort of obese Egyptian adolescents **(Sabry et al., 2023).**

Without interventions, NAFLD prevalence is expected to rise significantly worldwide by 2030**.** Addressing unhealthy lifestyle factors among T2DM patients with NAFLD is essential for mitigating these risks, emphasizing the importance of lifestyle interventions and healthcare support to improve outcomes and quality of life **(Teng et al., 2022).**

**Aim of study:**

The aim of this study was to assess the healthy lifestyle among Type 2 Diabetic patients with non-alcoholic fatty liver in the Main Assiut University Hospital.

**Research question:**

**Q1:** What does a healthy lifestyle Mean score of Type 2 Diabetic Patients with non-alcoholic fatty liver disease?

**Q2:** What is the quality of life among Type 2 Diabetic Patients with non-alcoholic fatty liver disease?

**Q3:** What is the knowledge level of Type 2 Diabetic Patients with non-alcoholic fatty liver disease?

**Q4:** What is the relationship between non-alcoholic fatty liver disease among Type 2 Diabetic patients and healthy lifestyle, quality of life, and their knowledge?

## Subject and Methods

**Research design:**

A descriptive research design was utilized to carry out this study. It was a helpful study strategy that was evidently beneficial in aiding in the description and investigation of relevant variables and constructs **(Jain, 2021).**

**Setting:**

This study was conducted in the diabetic center at the Main Assiut University hospital; it was located on the first floor. The center includes six specialized outpatient clinics, which are: the Health Education Clinic, the Diabetic Foot Clinic, the Diabetes Follow-up Clinic, the Endocrinology Clinic, the Diabetes Complications Clinic, and the Nutritional Therapy Clinic. The center serves patients from across Upper Egypt, aiming to improve their quality of life and manage the challenges of living with diabetes.

**Sample size and technique**

A simple random sample was used in this study. EPI info 7software was used to estimate the subject size based on the following parameters. The number of cases as medical record in the hospital was 3600 and the prevalence in Egypt was 57.65%.

- Population size (for finite population correction factor or (fpc) (N):3600
- Hypothesized % frequency of outcome factors in the population (p): 57.65%+/-5.
- Confidence limits as % of 100(absolute +/- (%) (d): 5%.
- Design effect (for cluster surveys-DEFF): With 95% confidence interval (CI).
- The estimated sample size was found to be 340 patients. To compensate for the drop out 20% added to the sample size, the final sample size was 408.

**Tools for data collection:**

Three tools were developed by the researcher based on reviewing the relative national and international scientific literature **(Rathnayake et al., 2020 & Ohaeri& Awadalla, 2009).** The study tools included the following:

**Tool (I): Interview questionnaire:** It included two parts: -

**Part (1):** Personal characteristics as, age, sex, residence, marital status, occupation, level of education & BMI. Weight and height were also acquired to assess each Patients' body mass index (BMI) using the equation of body weight divided by the square of the patients' height ($kg/m^2$). Based on the BMI, Patients were classified as underweight (<18.5), normal (18.5–24.9), overweight or pre-obesity (25-29.9), obesity class I (30-34.9), obesity class II (35-39.9) and obesity class III (>40) **(WHO, 2010).**

**Part (2):** The patient's knowledge of Nonalcoholic Fatty Liver Disease (NAFLD) was assessed through six multiple-choice questions covering various aspects: the definition (1 question), causes (5 questions), risk factors (11 questions), symptoms (10 questions), complications (5 questions), and prevention methods (5 questions) (**Mitrovic et al., 2023; Ristic-Medic et al., 2022; Kaya et al., 2022; Kosmalski et al., 2022 & Younossi et al., 2021)**

**Scoring system:**

For the knowledge items, a correct answer was scored 1 and zero for the incorrect &didn't know. For each area of knowledge, the scores of the items were summed up and the total divided by the number of the items and gave a mean score. Total knowledge ranged from 0-37 points. When the Mean was high, it was considered better knowledge.

**Tool (II): Health-Promoting Lifestyle Profile [HPLP II] Instruments to Measure Health Promoting Lifestyle: (Adult Version).**

It is a 52-item questionnaire composed of six subscales including health responsibility (9 items), nutrition (9 items), physical activity (8 items), stress management (8 items), interpersonal relations (9 items), and spiritual growth (9 items). The domain of health responsibility evaluates a patient's commitment to preventive healthcare, such as regular check-ups, following medical advice, and seeking reliable health information. The physical activity domain examines exercise habits, daily movement, and efforts to avoid a sedentary lifestyle. The nutrition domain focuses on healthy eating patterns, including balanced meals, hydration, and mindful food choices **(Rathnayake et al., 2020).**

The stress management domain assesses coping strategies, emotional regulation, and relaxation techniques to handle daily pressures. The spiritual growth domain reflects personal values, a sense of purpose, mindfulness, and the ability to find inner peace. Finally, interpersonal relationships domain measures the ability to build and maintain supportive social connections, communicate effectively, and engage in positive interactions **(Rathnayake et al., 2020).**

**Scoring system:**

The 52-item summated behavior rating scale employs a 4-point response (Never (N) = 1, Sometimes (S) = 2, Often (O) = 3, Routinely (R) = 4). A score for overall health-promoting lifestyle is obtained by calculating a mean of the individual's responses to all 52 items; six subscale scores are obtained similarly by calculating a mean of the responses to subscale items. The use of means rather than sums of scale items is recommended to retain the 1 to 4 metric of item responses and to allow meaningfully **(Rathnayake et al., 2020)**.

**Tool (III): Quality of life assessment scale:** The scale included information related to the original scale constructed by and from WHO (2009). It consists of 26 items. Individual items are rated on a 5-point Likert scale. The first question evaluates QOL in general, this question is called the Single Item Score (SIS); and the second question evaluates health condition satisfaction. The other 24 questions are grouped into 4 domains including: psychological (6 items), social (3 items), environment (8 items) and physical domain (7 items).

The physical health domain includes items on mobility, daily activities, functional capacity, energy, pain, and sleep. The psychological domain measures include self-image, negative thoughts, positive attitudes, self-esteem, mentality, learning ability, memory concentration, religion, and mental status. The social relationships domain contains questions on personal relationships, social support, and sex life. The environmental health domain covers issues related to financial resources, safety, health and social services, living physical environment, opportunities to acquire new skills and knowledge, recreation, general environment (noise, air pollution, etc.), and transportation **(Ohaeri& Awadalla, 2009).**

**Scoring system:**

The score range of the questionnaire is from 26 to 130: The scores of the items are summed up and the total divided by the number of the items, given a mean score for quality of life **(Ohaeri& Awadalla, 2009).**When the Mean was high, it was considered better quality of life.

**Face validity and reliability**

Tools validity and reliability were tested by panel of five professional health care providers including four faculty members of Community Health Nursing Faculty of Nursing, Assiut University, and one member of Medical -Surgical Nursing, Faculty of Nursing, Assiut University who reviewed the tools, for clarity, relevance comprehensive, understanding, applicability and easiness. **Reliability** of the tools was measured by Cronbach's alpha, the scale of

Knowledge questions was 0.852, Health promotion (0. 901) and Quality of life was 0.94.

**Pilot study**

A pilot study involved 10% of the study sample (41 patients) who were included in the study because there is no change in the questionnaire. A pilot study conducted to test the clarity of the tools and to estimate the required time to fill the questionnaire.

**Ethical consideration**

Prior to initiating the study, ethical approval was obtained from the ethical committee of the Faculty of Nursing, Assiut University dated 26\12\2023 committee number1120230735. The researcher guaranteed the patients' privacy and confidentiality throughout the study, and there was no risk to the study subjects. An explanation of the purpose and methodology of the study was conducted to examine patients. Verbal informed consent was obtained from patients that are willing to participate in the study, after explaining the nature and purpose of the study, and the patients were reminded of their right to decline participation.

**Fieldwork phase**

- An official permission from the general director of the hospital and the head of the diabetic center were taken to facilitate the data collection.
- The researcher met and greeted the patients in the diabetic center at the Main Assiut University hospital, introduced self and explained the purpose of the study. Furthermore, asked the patients to participate in the study after assuring the confidentiality of their data.
- Informed consent was taken from the patients after explanation the purpose of the study.
- This study was carried out through a period of four months from the beginning of September 2024 to the end of December 2024.
- The length of interview to fill the interview questionnaire was about 20 to 30 minutes for each patient, ranged from 3-4 patients a day depending upon their understanding and response. The researcher went to hospital three days per week (Sunday, Wednesday and Thursday) from 8 am to 12 pm to collect data from studied patients.

## Statistical analysis:

The data was tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by number and percentage (N, %), where continuous variables are described by mean and standard deviation (Mean, SD). The Chi-square test and fisher exact test used to compare between categorical variables where compare between continuous variables by t-test and ANOVA TEST. We are used person Correlation to Appear the Association between scores. All analyses were performed with the IBM SPSS 20.0 software.

## Results

**Table (1): Socio demographic characteristics of the studied patients at Assiut Diabetic Center (n=408)**

| Demographic characteristics | No | % |
|---|---|---|
| **Age group** | | |
| Less than 40 years | 68 | 16.6 |
| From 40 – less than 50 years | 93 | 22.8 |
| From 50-60 years | 128 | 31.4 |
| More than 60 years | 119 | 29.2 |
| **Mean±SD (range)** | **53.87±10.71(31-75)** | |
| **Gender** | | |
| Male | 181 | 44.4 |
| Female | 227 | 55.6 |
| **Social status** | | |
| Single | 17 | 4.2 |
| Married | 304 | 74.5 |
| Widow | 78 | 19.1 |
| Divorced | 9 | 2.2 |
| **Level of education** | | |
| Illiterate | 125 | 30.6 |
| Reads and write | 111 | 27.2 |
| Basic education | 44 | 10.9 |
| Secondary | 56 | 13.7 |
| University | 72 | 17.6 |
| **Occupation** | | |
| Craft work | 36 | 8.8 |
| Farmer | 43 | 10.5 |
| Private work | 25 | 6.2 |
| Housewife | 182 | 44.6 |
| Retired | 31 | 7.6 |
| Government employee | 91 | 22.3 |
| **Residence** | | |
| Rural | 252 | 61.8 |
| Urban | 156 | 38.2 |
| **Body Mass Index** | | |
| Normal weight | 20 | 4.9 |
| Overweight | 135 | 33.1 |
| Class I Obesity | 170 | 41.7 |
| Class II Obesity | 45 | 11 |
| Class III Obesity | 38 | 9.3 |
| **Mean±SD (range)** | **32±5.07(22.28-46.71)** | |

*Frequencies (number, percentage and Mean±SD).*

**Table (2): Mean score of Health Promoting Lifestyle, knowledge and Quality of Life assessment scale among Nonalcoholic Fatty Liver Patients (n=408)**

| Variable | Max Score | Mean±SD | Min- Max |
|---|---|---|---|
| **Subdomains of Health Promoting Lifestyle** | | | |
| Nutrition | 36 | 26.66±4.96 | 14-36 |
| Physical Activity | 32 | 16.33±6.47 | 8-32 |
| Health responsibility | 36 | 24.98±6.07 | 13-36 |
| Spiritual growth | 36 | 27.51±5.41 | 10-36 |
| Interpersonal relations | 36 | 28.88±5.26 | 15-36 |
| Stress management (SM) | 32 | 22.48±4.42 | 11-32 |
| **Health Promoting Lifestyle** | **208** | **146.84±27.06** | **91-204** |
| **knowledge about Nonalcoholic fatty liver disease** | **37** | **13.25±5.28** | **3-28** |
| **Subdomains of Quality of life** | | | |
| Global | 10 | 7.12±1.39 | 2-10 |
| Physical domain | 35 | 22.07±2.7 | 15-29 |
| Psychological | 30 | 19.34±2.89 | 10-26 |
| Social | 15 | 11.04±1.98 | 4-15 |
| Environmental | 40 | 22.84±5.09 | 11-34 |
| **Quality of life assessment scale** | **130** | **82.41±11.42** | **47-106** |

*Frequencies (number and Mean ± SD).*

**Table (3): Relation between Patient's knowledge about Nonalcoholic Fatty Liver Disease and their socio demographic data (n=408)**

| | N | Patient's knowledge about Nonalcoholic fatty liver disease | | Test Used | P.value |
|---|---|---|---|---|---|
| | | Mean±SD | Range | | |
| **Age group** | | | | | |
| Less than 40 years | 68 | 15.03±6.53 | 3-27 | 3.57 | 0.014* |
| From 40 –less than 50 years | 93 | 13.18±5.17 | 5-28 | | |
| From 50-60 years | 128 | 13.09±5.05 | 5-27 | | |
| More than 60 years | 119 | 12.46±4.6 | 4-20 | | |
| **Gender** | | | | | |
| Male | 181 | 14.16±4.89 | 5-27 | 3.14 | 0.002** |
| Female | 227 | 12.52±5.47 | 3-28 | | |
| **Social status** | | | | | |
| Single | 17 | 18.12±6.05 | 8-27 | 5.41 | 0.001** |
| Married | 304 | 13.12±5.05 | 3-28 | | |
| Widow | 78 | 12.64±5.5 | 4-27 | | |
| Divorced | 9 | 13.67±5.77 | 8-21 | | |
| **Level of education** | | | | | |
| Illiterate | 125 | 11.52±4.66 | 4-24 | 14.62 | 0.000** |
| Reads and write | 111 | 14.24±5.21 | 5-27 | | |
| Basic education | 44 | 13.73±4.04 | 7-21 | | |
| Secondary | 56 | 10.93±4.79 | 3-21 | | |
| University | 72 | 16.24±5.65 | 8-28 | | |
| **Occupation** | | | | | |
| Craft work | 36 | 15.08±5.26 | 6-23 | 8.46 | 0.000** |
| Farmer | 43 | 11.88±4.74 | 5-21 | | |
| Private work | 25 | 14.68±4.53 | 8-21 | | |
| Housewife | 182 | 11.95±4.92 | 3-27 | | |
| Retired | 31 | 12.61±4.36 | 6-19 | | |
| Government employee | 91 | 15.6±5.68 | 6-28 | | |
| **Residence** | | | | | |
| Rural | 252 | 12.81±4.87 | 3-27 | -2.17 | 0.030* |
| Urban | 156 | 13.97±5.82 | 5-28 | | |

| | N | Patient's knowledge about Nonalcoholic fatty liver disease | | Test Used | P.value |
|---|---|---|---|---|---|
| | | Mean±SD | Range | | |
| **Body Mass Index** | | | | | |
| Normal weight | 20 | 13.75±5.52 | 6-21 | 4.34 | 0.002** |
| Overweight | 136 | 13.67±5.29 | 4-27 | | |
| Class 1 Obesity | 169 | 12.46±5.12 | 3-27 | | |
| Class II Obesity | 45 | 12.36±4.83 | 4-23 | | |
| Class III Obesity | 38 | 16.05±5.41 | 9-28 | | |

*Independent T-test quantitative data between the two groups*
*One-way Anova T-test quantitative data between the three groups or more*

**Table (4): Relation between Health Promoting Lifestyle with socio demographic data of Nonalcoholic fatty liver Patients(n=408)**

| | N | Health Promoting Lifestyle | | Test Used | P. value |
|---|---|---|---|---|---|
| | | Mean±SD | Range | | |
| **Age group** | | | | | |
| Less than 40 years | 68 | 150.99±15.69 | 129-179 | 10.59 | 0.000** |
| From 40 - less than 50 years | 93 | 157.85±23.68 | 119-193 | | |
| From 50-60 years | 128 | 144.56±28 | 96-202 | | |
| More than 60 years | 119 | 138.33±30.35 | 91-204 | | |
| **Gender** | | | | | |
| Male | 181 | 155.08±28.47 | 91-204 | 5.69 | 0.000** |
| Female | 227 | 140.28±23.99 | 96-194 | | |
| **Social status** | | | | | |
| Single | 17 | 144.18±13.27 | 114-164 | 42.26 | 0.000** |
| Married | 304 | 154.16±25.59 | 102-204 | | |
| Widow | 78 | 122.4±16.96 | 96-160 | | |
| Divorced | 9 | 116.67±20.93 | 91-139 | | |
| **Level of education** | | | | | |
| Illiterate | 125 | 132.28±24.14 | 96-203 | 23.36 | 0.000** |
| Reads and write | 111 | 146.79±26.72 | 103-204 | | |
| Basic education | 44 | 154.05±26.47 | 119-193 | | |
| Secondary | 56 | 148.86±22.56 | 91-194 | | |
| University | 72 | 166.24±21.57 | 120-202 | | |
| **Occupation** | | | | | |
| Craft work | 36 | 164.89±26.12 | 114-203 | 25.36 | 0.000** |
| Farmer | 43 | 141.35±25.59 | 107-192 | | |
| Private work | 25 | 153.08±21.11 | 119-178 | | |
| Housewife | 182 | 136.44±21.85 | 96-193 | | |
| Retired | 31 | 133.97±35.38 | 91-204 | | |
| Government employee | 91 | 165.78±21.22 | 120-202 | | |
| **Residence** | | | | | |
| Rural | 252 | 139.94±25.91 | 96-202 | -6.91 | 0.000** |
| Urban | 156 | 157.99±25.17 | 91-204 | | |
| **Body Mass Index** | | | | | |
| Normal weight | 20 | 149.45±27.92 | 111-189 | 0.47 | 0.758 |
| Overweight | 136 | 148.36±27.13 | 91-204 | | |
| Class 1 Obesity | 169 | 146.64±25.82 | 101-203 | | |
| Class II Obesity | 45 | 145.93±31.6 | 96-202 | | |
| Class III Obesity | 38 | 142±26.79 | 96-183 | | |

*- Independent T-test quantitative data between the two groups*
*- One-way Anova T-test quantitative data between the three groups or more*

**Table (5): Relation between Quality of Life with socio demographic data among Nonalcoholic fatty liver Patients (n=408)**

| | N | Quality of life assessment scale | | Test Used | P. value |
|---|---|---|---|---|---|
| | | Mean±SD | Range | | |
| **Age group** | | | | | |
| Less than 40 years | 68 | 76.43±10.51 | 58-92 | 8.26 | 0.000** |
| From 40 -50 years | 93 | 78.72±8.8 | 56-96 | | |
| From 50-60 years | 128 | 75.43±10.81 | 42-94 | | |
| More than 60 years | 119 | 71.82±10.65 | 46-93 | | |
| **Gender** | | | | | |
| Male | 181 | 76.98±11.23 | 46-94 | 2.92 | 0.004** |
| Female | 227 | 73.94±9.81 | 42-96 | | |
| **Social status** | | | | | |
| Single | 17 | 69.41±9.16 | 56-81 | 35.43 | 0.000** |
| Married | 304 | 77.84±9.3 | 49-96 | | |
| Widow | 78 | 69.03±10.18 | 42-84 | | |
| Divorced | 9 | 54.67±7 | 46-62 | | |
| **Level of education** | | | | | |
| Illiterate | 125 | 70.08±9.85 | 42-85 | 17.54 | 0.000** |
| Reads and write | 111 | 76.72±10.42 | 56-96 | | |
| Basic education | 44 | 80.09±8.92 | 62-93 | | |
| Secondary | 56 | 73.64±11.15 | 46-90 | | |
| University | 72 | 80.49±7.87 | 59-93 | | |
| **Occupation** | | | | | |
| Craft work | 36 | 77.86±10.73 | 56-92 | 12.49 | 0.000** |
| Farmer | 43 | 73.4±10.52 | 54-93 | | |
| Private work | 25 | 79.72±11.7 | 59-94 | | |
| Housewife | 182 | 73.51±9.86 | 42-96 | | |
| Retired | 31 | 66.77±12.62 | 46-82 | | |
| Government employee | 91 | 80.42±7.42 | 62-93 | | |
| **Residence** | | | | | |
| Rural | 252 | 72.8±10.84 | 42-96 | -6.35 | 0.000** |
| Urban | 156 | 79.32±8.71 | 46-94 | | |
| **Body Mass Index** | | | | | |
| Normal weight | 20 | 73.1±13.35 | 54-92 | 0.52 | 0.721 |
| Overweight | 136 | 75.88±11.03 | 46-93 | | |
| Class 1 Obesity | 169 | 74.89±9.37 | 49-94 | | |
| Class II Obesity | 45 | 76.4±12.58 | 42-90 | | |
| Class III Obesity | 38 | 74.82±9.89 | 62-96 | | |

*- Independent T-test quantitative data between the two groups*
*- One-way Anova T-test quantitative data between the three groups or more*

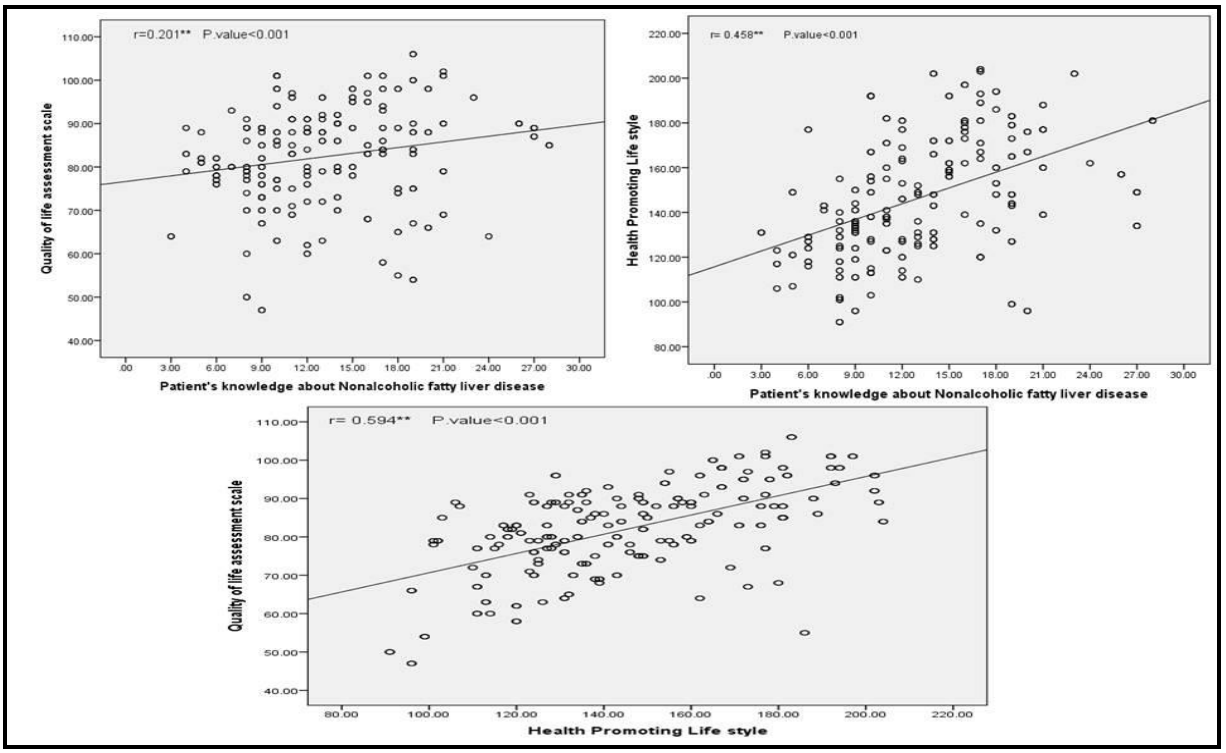


**Figure (1):Correlation between Patient's knowledge, Health Promoting Lifestyle, Quality of life assessment scale among Nonalcoholic fatty liver patients(n=408)**

**Table (1):** Showed that 31.4% of patients were in the 50-60 years age group, 55.6% of patients were female. Most patients are married (74.5%), 30.6% being illiterate, 44.6% housewives, 61.8%reside in rural areas, The predominance of obesity, particularly 41.7% of them were Class I Obesity and4.9% have a normal weight.

**Table (2):** Revealed the mean score of Health Promoting Lifestyle among studied patients, it was noticed that the mean score is higher in interpersonal relations with Mean±SD: 28.88±5.26 and spiritual growth (Mean±SD: 27.51 ± 5.41), physical activity has a lower mean score (Mean±SD16.33 ± 6.47).Additionally, the mean score of knowledge about Nonalcoholic fatty liver disease was (M= 13.25, SD=5.28).Regarding quality of life, it was found that the mean score of environmental domain was (M= 22.84, SD=5.09) which were higher than the mean score of social, psychological and physical domain (Mean±SD11.04±1.98, 19.34±2.89, 22.07±2.7).respectively.

**Table (3):** Demonstrated the highest mean score patient's knowledge informed by the studied sample who single followed by a university level of education, class III obesity, occupation government employee, male, live in urban area and aged group between 50-60 years, (Mean±SD18.12±6.05, 16.24±5.65, 16.05±5.41 , 15.6±5.68, 14.16±4.89, 13.97±5.82, 13.09±5.05 )respectively. Also, the table illustrated that there are statistically significant differences between patient's knowledge about nonalcoholic fatty liver disease and their demographic data at all items (P value < 0.05).

**Table (4):** Displayed that the highest mean score Health Promoting Life style reported by the studied sample who has a university level of education followed by occupation government employee, live in urban area, aged group 40 -50 years, male, married and has normal weight (Mean±SD166.24±21.57, 165.78±21.22, 157.99±25.17, 157.85±23.68, 155.08±28.47, 154.16±25.59, 149.45±27.92 ) respectively. Also, the table illustrated that there are highly statistically significant differences between Health Promoting Lifestyle with Their socio-demographic data at all items (P value < 0.05).

**Table (5):** Stated that the highest mean score Quality of life assessment described by studied sample who has a university level of education followed by live in urban area, aged group 40-less than 50 years, married, male, occupation government employee, male, and has Class II Obesity (Mean±SD80.49±7.87, 80.42±7.42, 79.32±8.71, 78.72±8.8, 77.84±9.3, 76.98±11.23, 76.4±12.58)respectively. Also, the table illustrates that there are highly statistically significant differences between Quality of life assessment scale with their socio demographic except body mass index (P value <0.721)

**Figure (1): Clarified that** there is a positive correlation between patient's knowledge about Nonalcoholic fatty liver disease and Health Promoting Lifestyle (r=0.458), (P value = <0,001), positive correlation between Patient's knowledge and Quality of life assessment scale (r=0.201), (P value= <0,001) moreover, there is positive correlation between Health Promoting Lifestyle and Quality of life assessment scale (r=0.594), (P value= <0,001).

## Discussion:

Non-alcoholic fatty liver disease is the leading cause of chronic liver disease globally. The combinations of obesity, fatty liver, type 2 diabetes mellitus (DM) are potential risk factors for morbidity and mortality. These morbidities include abnormalities of fat and glucose metabolism, insulin resistance and DM. Its prevalence is exponentially increasing at the same rate as type 2 diabetes mellitus (T2DM) and obesity, as a consequence of a lifestyle based on unhealthy eating habits and sedentarism **(Hegazy et al., 2024).**

In addition, a significant proportion of obese and overweight people have nonalcoholic fatty liver disease. Considering that maintaining a healthy lifestyle and losing weight are still the cornerstones of NAFLD care, it is alarming that there is a paucity of knowledge about NAFLD as a preventable illness that maybe controlled in its early stages **(Hegazy et al., 2024).** So, the present study aimed to assess healthy lifestyle among Type 2 Diabetic patients with non-alcoholic fatty liver.

The demographic findings of this study revealed that one third of the studied patients were within the 50–60 years age group, with a mean age of 53.87 ± 10.71 years. This is consistent with the findings of **Funuyet-Salas et al. (2021)**, in their study titled " Quality of Life and Coping in Nonalcoholic Fatty Liver Disease: Influence of Diabetes and Obesity"**,** who reported that most patients with Nonalcoholic Fatty Liver Disease (NAFLD) were above 50 years old.

Additionally, the current study showed that more than half of the studied sample were females, as they tend seek the medical care and follow-up more frequently than males, which aligns with **Michel et al. (2024)** and **Hegazy et al. (2024),** both of them showed that no major differences were seen between males and females. While, these results contrast with **Funuyet-Salas et al. (2021),** in study conducted in Spain, who found that the majority of NAFLD patients were males, indicating that gender distribution in NAFLD may vary across populations and settings.

In terms of social characteristics, most participants resided in rural areas, Conversely, some studies, such as **Lin et al. (2021)** and **Abebe et al. (2022)** both reported a higher prevalence of NAFLD in urban populations, potentially due to differences in lifestyle and dietary habits. Furthermore, one third of them are illiterate individuals. This supports the observations of **Funuyet-Salas et al. (2021),** who noted that lower educational levels and socioeconomic status are risk factors for NAFLD development.

Regarding obesity, this study highlighted a predominance of Class I obesity and overweight among the participants, with a mean BMI of 32 ± 5.07. These results are consistent with **Abebe et al. (2022)** in their study " Assessment of fatty liver and its correlation with glycemic control in patients with type 2 diabetes mellitus attending Dessie Comprehensive Specialized Hospital, Northeast Ethiopia" who found a strong association between higher BMI and the prevalence of NAFLD, particularly among patients with Type 2 Diabetes Mellitus (T2DM). This aligns with the established relationship between obesity, insulin resistance, and liver steatosis. However, in contrast, a study by **Huang et al. (2024)**, in their study titled "The effect of a multidisciplinary lifestyle modification program for obese and overweight children" reported that lean NAFLD, although less prevalent, remains a significant public health concern in certain populations, indicating the multifactorial nature of the disease.

The assessment of health-promoting lifestyles in this study revealed suboptimal scores in physical activity and stress management among the participants (Mean±SD 16.33±6.47, 22.48±4.42), respectively. This finding agrees with **Li et al. (2022)** in a study conducted at the Health Administration Center of a tertiary hospital in Zhangjiagang City from July to December 2019**,** who noted similar trends in patients with chronic liver diseases, where sedentary physical exercise and stress are prevalent (Mean±SD20.04±3.07,18.02±2.26), respectively and **Vachliotis et al. (2022)** in their research" Nonalcoholic fatty liver disease: lifestyle and quality of life", noted similar findings according to physical activity.

However, the current study showed that there were high scores in interpersonal relations and spiritual growth (Mean±SD28.88±5.26, 27.51±5.41), respectively. This indicates that patients might rely on social and emotional support to cope with their health challenges. This differs from the findings of **Li et al. (2022),** who reported relatively high scores in health responsibility (M=25.83, SD=2.55).

The study found a significant relation between socio-demographic factors and health-promoting lifestyle (HPL) scores. Younger age groups (<40 and 40–less than 50 years) exhibited higher HPL scores (M=150.99, SD= 15.69 and 157.85 ± 23.68, respectively) compared to older groups. This is

consistent with **Younossi et al., (2022)** in their research "Fatty Liver Through the Ages: Nonalcoholic Steatohepatitis"**,** who reported that younger individuals are more proactive in adopting healthy behaviors. The educational level was positively correlated with HPL, with university-educated patients scoring the highest Mean (M=166.24, SD=21.57). In contrast, **Chen et al. (2022)** found that even individuals with secondary education could achieve significant lifestyle improvements through structured interventions.

Occupation significantly impacted HPL, with government employees and craft workers scoring the highest (M=165.78, SD= 21.22 and M=164.89, SD= 26.12), respectively. These findings align with **Lin et al. (2021)**, who observed that structured work environments promote regular physical activity and stress management. However, housewives scored lower (M=136.44, SD= 21.85), reflecting limited access to structured health promotion activities.

Urban residents had higher HPL scores (M=157.99, SD=25.17) than rural residents (M=139.94, SD=25.91), reflecting disparities in health promotion resources. This supports findings by **Funuyet-Salas et al. (2021)**, but contrasts with **Zhu et al. (2023)** in their research " Dietary patterns and metabolic dysfunction-associated fatty liver disease in China's multi-ethnic regions", who found that rural populations are maintained higher physical activity levels due to agricultural work.

The findings of this study indicated that the overall knowledge score about NAFLD among patients was low, with a mean score of 13.25 ± 5.28. This aligns with the results of **Morrill et al. (2021)** in their research "Awareness, Knowledge, and Misperceptions Related to Nonalcoholic Fatty Liver Disease in a Community Sample of Mexican-Origin Women: A Mixed Methods Study", who noted that overall knowledge about NAFLD were very low among those who participated. In the present study, age and gender were statistically significant difference with knowledge (P value 0.014), with younger patients and males (P value 0.002). These results are consistent with **Li et al. (2021),** who noted that younger individuals are more likely to have better access to health information, particularly through digital platforms about NAFLD.

The educational level in the current study also played a critical role, with university-educated participants scoring the highest level of knowledge (P value 0.000). This is in line with findings by **Abebe et al. (2022)** in Ethiopia**,** who emphasized the role of education in promoting disease awareness. However, the researcher believes that the reasons for this increase of knowledge appear to be linked to several factors such as the increase in the level of education inpatients that make them read more about their disease on internet and seeking to improve the healthy lifestyle to prevent the complications of their disease.

Gender differences were also evident, with males demonstrating higher Mean knowledge scores (M=14.16, SD= 4.89) than females (M=12.52, SD=5.47). This supports the findings of **Funuyet-Salas et al. (2021)**, who suggested that men might have better access to health-related information through occupational networks or greater healthcare engagement. However, these findings differ from **Hegazy et al. (2024)** in Egypt, in their study titled Non-alcoholic fatty liver disease related knowledge among a sample of Egyptians: an exploratory cross-sectional study, who found minimal gender differences, likely due to gender-focused health programs in their study population.

Urban residents scored higher Mean in knowledge (M=13.97, SD= 5.82) compared to rural residents (M=12.81, SD=4.87), reflecting better access to healthcare facilities and educational resources in urban areas. These findings align with **Lin et al. (2021)** study conducted in China, who suggested that rural populations might show higher adherence to traditional health practices, which could compensate for lower knowledge levels. In contrast **Yip et al, (2023),** who reported that the gap among geographical regions and between rural and urban areas has been decreasing. Body Mass Index (BMI) was another statistically significant factor, Patients with Class III obesity scored the highest (p value 0.002), likely due to greater interaction with healthcare providers. This aligns with **Carrieri et al. (2022),** who noted that patients with higher BMI often receive targeted counseling for metabolic disorders.

This study discovered that the mean quality of life (QoL) score was (M=82.41, SD=11.42, with notable variations across subdomains. The physical and environmental domains scored higher (Mean±SD22.07±2.7, 22.84±5.09), respectively indicating stronger interpersonal relationships and coping mechanisms in the studied population and indicated that there are lower scores in the social and psychological domains. These findings are differed with **Golubeva et al. (2022)** who reported patients with NAFLD suffered from significant impairment of their QoL, related to physical health and align in psychological domains.

The present study revealed significant associations between QoL and socio-demographic factors. This aligns with **Abdullah et al. (2021),** who found that there was a statistically significant relation between QoL of studied sample and their age, marital status and level of education.

The results showed a positive correlation (r=0.458, p<0.001) between knowledge and HPL. This indicates that patients with higher knowledge about NAFLD tend to exhibit better health-promoting behaviors, such as proper nutrition, physical activity, and stress management. This result aligns with **Chen et al. (2022)**, who found that patient education significantly improved adherence to lifestyle modifications, particularly among patients with chronic liver diseases.

The study revealed a positive correlation (r=0.201, p<0.001) between knowledge and QoL, suggesting that patients who possess greater knowledge about NAFLD experience better overall well-being. This can be attributed to possessing greater knowledge about NAFLD allows patients to be more involved in their health decisions, reduces psychological burdens, and encourages healthier behaviors, all of which contribute to a better quality of life.

This finding is consistent with **Singh et al. (2021) & Kumar et al. (2023)**, both of which highlighted that patient education enhances psychological and social domains of QoL by alleviating fear and promoting informed decision-making. However, **Funuyet-Salas et al. (2021)** reported weaker associations between knowledge and QoL in populations with low literacy levels, indicating the need for tailored educational interventions to overcome barriers.

A strong positive correlation (r=0.594, p<0.001) was observed between HPL and QoL, indicating that patients who engage in healthier lifestyles report significantly higher QoL scores. Improved physical activity, balanced diets, and effective stress management likely contribute to enhanced physical and psychological well-being. This result agrees with **Abebe et al. (2022)**, who documented lifestyle interventions, particularly weight loss and exercise programs, significantly improved QoL in patients with NAFLD. Contrarily, **Ali et al. (2021)** reported less significant improvements in QoL among patients with socio-economic constraints, underscoring the role of environmental and financial factors in sustaining lifestyle changes.

## Conclusion:

The study concludes that there is a low knowledge level regarding NAFLD. Health Promoting Lifestyle was low in physical activity subdomain and low in social domain in Quality of life. There are socio-demographic factors significantly influence patients' knowledge about NAFLD, adoption of health-promoting lifestyles, and QoL. Notably, better education, urban residence, and employment in government roles are associated with improved outcomes. Furthermore, fostering knowledge about NAFLD can positively impact health-promoting behaviors and overall QoL.

## Recommendations

- Health educational programs for patients with NAFLD should be applied periodically to improve knowledge, Health Promoting Lifestyle and Quality of life for those patients.
- Target educational and lifestyle intervention efforts at groups with lower QoL and knowledge levels, such as older adults, rural residents, and individuals with obesity.
- Develop personalized physical activity plans that accommodate the varying health statuses and fitness levels of patients with NAFLD. Encourage simple activities like walking, swimming, or low-impact exercises.
- Integrating information about NAFLD and its prevention into routine medical visits, especially for patients with risk factors such as obesity, diabetes, and metabolic syndrome, will improve knowledge and encourage lifestyle changes.

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