Diversified Program and Targeting Lifestyle Modification among Obese Patients with Non-Alcoholic Fatty Liver Disease

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Abstract:

Background: Non-Alcoholic Fatty Liver Disease (NAFLD) is a lifestyle-related disorder with a significant global public health concern. Healthy lifestyle changes like dietary adjustments, consistent physical exercise, and gradual weight loss are the ideal strategies which applied together to manage the disease. **Aim:** to investigate the effect of a diversified program on lifestyle modification among obese patients with non-alcoholic fatty liver disease. **Research Design:** A quasi-experimental research design (pre-posttest) was utilized to achieve the aim of the study. **Setting:** The study was conducted at the internal medicine outpatient clinics of Menoufia University Hospital in Menoufia Governorate, Egypt. **Sample:** A purposive sample of 104 adult male and female obese patients with a confirmed diagnosis of NAFLD was selected. **Tools:** Four tools were utilized to collect data: (I) Personal and Medical Data Form, (2) Patient Knowledge Assessment Questionnaire, (3) Physical Activity Assessment Form, and (4) Lifestyle Modification Assessment Questionnaire. **Results:** All research hypotheses were supported; statistical significant differences were found between the pre and post intervention in relation to knowledge level, physical activity as well as lifestyle modification. **Conclusion:** Diversified program has a significant positive effect post intervention on obese patients with NAFLD. **Recommendation**: Implementing the diversified program on a larger probability sample is recommended.

Keywords: Diversified Program, Targeting, Lifestyle Modification, Obese Patients, Non-Alcoholic Fatty Liver Disease.

Introduction

A disorder known as fatty liver disease occurs when fat deposits accumulate in the liver cells. Alcoholic fatty liver disease (AFLD) and non-alcoholic fatty liver disease (NAFLD) are the two primary clinical subgroups. Non-alcoholic fatty liver disease (NAFLD) is one of the most prevalent liver illnesses globally, affecting over 25% of the population worldwide. According to the latest figures, it is significantly more common in developed nations, impacting as much as one-third of the adult population **(Younossi, Rinella & Sanyal, 2021).** It is anticipated that NAFLD will play a larger role in the morbidity and mortality associated with liver disease, and it is expected that in the near future, it will be the primary indicator for liver transplantation **(Singh, et al., 2022).**

It can be described as a silent illness that is strongly linked to metabolic risk factors as dyslipidemia, obesity, and type 2 diabetes mellitus. If untreated, it can lead to cirrhosis, fibrosis, and hepatocellular carcinoma **(Sookoian, Pirola & Wilson, 2020).** It is frequently asymptomatic and is typically discovered accidently during abdominal ultrasonography exams or liver blood testing. When present, the symptoms are ambiguous and include dyspepsia, tiredness, and right upper quadrant discomfort **(Kim, Sinn &Kang, 2022).**

According to **Paul, et al. (2018), NAFLD** is the most frequent cause of abnormal

liver function tests and ultrasound imaging. More than four times the upper normal range of alanine aminotransferase (ALT) is typically seen in obese patients with NAFLD. When compared to healthy persons, obese patients with NAFLD frequently consume larger amounts of calories, saturated fat, cholesterol, and lower levels of fiber, polyunsaturated fatty acids, as well as vitamins C and E **(Oseini, et al., 2018).** Losing weight can lessen inflammation and fibrosis linked to NAFLD, in addition to reducing the amount of hepatic fat **(Eslam, Sanyal, & George, 2020).**

Based on data presented by the World Health Organization (WHO), Egypt was ranked as the 14th fattest country in the world and the "fattest African country" in 2010. According to a 2012 WHO survey, over 62% of Egyptian adults were overweight, and 31.3% were considered obese **(World Health Organization, 2014).** Almost time, Egypt has seen a rise in the number of fat people; currently, more than one-third of Egyptians are obese, the highest percentage worldwide **(Abdel-Maksoud & Hassanein, 2021).**

An unhealthy lifestyle has a strong correlation with NAFLD. Patients' management of NAFLD revolves around changing their lifestyle, which results in a 5–10% weight loss. On the other hand, opinions regarding the specific food choices and approaches that might work best for managing NAFLD are not widely agreed upon. It's currently accepted knowledge that obese NAFLD patients overeat. Moreover, it has been demonstrated that NAFLD patients are more sedentary and engage in less physical activity than their healthy counterparts. Increasing exercise levels and decreasing time spent in sedentary positions not only boost energy expenditure and facilitate weight reduction, but also mitigate metabolic and cardiovascular hazards **(Zhou, Wu & Liu, 2021).**

Many calories and insufficient exercise are two examples of lifestyle variations in NAFLD patients. Because of this, physicians and dietitians typically recommend a "one size fits all" strategy for weight loss to all obese patients with NAFLD, which includes calorie restriction and increase in exercise. The longevity of these two lifestyle changes is hampered by issues including patient motivation and adherence challenges **(Chalasani, Younossi & Lavine, 2018)**. Merely 5% of patients manage to reduce their body weight by 10%. Following this, there is a decline in lifestyle modification compliance, and weight loss quickly returns **(Wong et al., 2021).** That likely results from a lack of knowledge about the variations in the lifestyles of obese patients with NAFLD and, consequently, from a lack of tailored lifestyle modifications for each NAFLD patient **(El-Sayed & Ibrahim, 2022).**

Oftentimes, nurses are in the ideal position to encourage early diagnosis and management of NAFLD. It is not always the case that abnormal liver function tests (LFTs) are the only basis for a diagnosis; occasionally, the findings of these blood tests are not raised. When it comes to promoting health to all patients diagnosed with NAFLD, practice nurses are crucial **(Nasr & Elsabagh, 2021).** But it's possible that a large number of people are ignorant of their illness and haven't obtained the necessary care **(Buzzetti, Pinzani &Tsochatzis, 2021).** Thus, the aim of the current study is to investigate the effect of diversified program on lifestyle modification among obese patients with non-alcoholic fatty liver disease.

Significance of the study

Globally, obesity is reaching epidemic proportions. If current trends continue, it is estimated that the proportion of overweight or obese adults worldwide will rise from 33% in 2005 to 58% by 2030. In Egypt, obesity is becoming a bigger public health issue. It is estimated that 35 percent of Egyptian adults (16.3% of males and 18.7% of females) are obese. Patients with NAFLD who exhibit advanced fibrosis and steatohepatitis are significantly more likely to experience unfavorable outcomes, such as general and liver-specific morbidity and mortality, respectively. Given the worse outcomes that are linked with this cohort of patients with NAFLD, identifying them is critical to allocating resources to the individuals who most need them. NAFLD is not limited to Egypt, it is the second most prevalent cause of liver

transplantation and the most common cause of chronic liver disease worldwide (Nasr, Ignatova, Kechagias & Ekstedt, 2018).

According to a consensus statement on NAFLD, the disease is estimated to impact around 25% of the adult global population, resulting in a significant health burden with extensive social and economic consequences. Nevertheless, most patients and allied health professionals are ignorant of it despite its ubiquity of the grave consequences that come with having this diagnosis (Mikolasevic & Filipec, 2018). Enlisting in a weight loss program is an effective way to reduce body weight and increase physical activity in the near term. Dietary therapy combined with physical activity is the gold standard treatment for obese patients with NAFLD (Younossi, Marchesini, Pinto &Petta, 2019). Numerous studies have demonstrated that efficient weight loss achieved through calorie restriction and increased physical exercise improves liver function, histology, and lifestyle. So, the study aimed to investigate the effect of diversified program on lifestyle modification among obese patients with non-alcoholic fatty liver disease. It is hoped that the results of this study will provide evidence-based information that can improve patient management quality and, in turn, improve health and activity levels.

Aim of the study

The aim of the current study was to investigate the effect of diversified program on lifestyle modification among obese patients with non-alcoholic fatty liver disease.

Research hypotheses:

H1.The total mean score of knowledge level post intervention will differ from the pre intervention among the study sample.

H2. The total mean score of physical activity assessment post intervention will differ from the pre intervention among the study sample.

H3. The total mean score of lifestyle modification questionnaire post intervention will differ from the pre intervention among the study sample.

Operational definitions

Diversified Program: it means the lifestyle modification program designed for obese patients with NAFLD, and implemented through providing dietary and physical exercises instructions to reduce obesity and improve liver function.

Lifestyle Modification: means a combination of dietary therapy and scheduled physical exercise as measured by Lifestyle Modification Assessment Questionnaire.

Methods

Research Design: A quasi-experimental research design (pre-posttest) was utilized to achieve the aim of the current study. This design compares a variable's pre- and post-intervention ratings to determine the impact of an intervention (Stratton, 2019). To measure the effect, a pre-posttest was employed to investigate the effect of a diversified program on lifestyle modification post-intervention.

Setting: The study was conducted at the internal medicine outpatient clinics of Menoufia University Hospital in Menoufia Governorate, Egypt.

Sample: A purposive sample of 104 adult patients was selected. According to Ghaemi, et al., (2013), with power 80% and confidence level 95% and considering for a possible loss. The sample size was calculated and found to be 104 patients.

Inclusion criteria:

1.Male and female patients aged 18 years and above.

2.Having confirmed diagnosis of NAFLD by liver function tests and abdominal ultrasonography.

3.Free from Hepatitis A, B, or C.

4.Obese with a Body Mass Index (BMI) of 30 Kg/m2 and above.

Exclusion criteria:

1. Patients underwent stomach reduction surgery such as jejuno-ileal or gastric bypass.
2. Having chronic disease such as cardiac , renal , and thyroid disorders.
3. Prior diagnosis of secondary cause of fatty liver as Wilson's disease, steatohepatitis, autoimmune liver disease, or cirrhosis.
4. Having history of alcohol consumption.

Tools

Four tools were developed by the researchers and utilized to collect the necessary data pertinent to the study. These tools were as follow:

Tool I: Personal and Medical Data Form: It includes demographic and related medical data about the study sample as age, gender, marital status, education, occupation & place of residence. Medical data comprised data about smoking, sitting time, body weight, Body Mass Index (BMI), and finally laboratory and diagnostic tests.

Tool II: Patient Knowledge Assessment Questionnaire: It consists of eight questions about NAFLD definition, causes, manifestations, complications, preventive measures, type of food, and drinks which alleviate, and aggravate its manifestations. There are three possible answers for each question: a correct complete response receives a score of 2, an incomplete response receives a score of 1, and a wrong response receives a score of 0. Based on Paolicchi, et al. (2016), the responses were ranked from 1 to 16 and classified as Poor (<50%), Fair (50–75%), and Good (>75%).

Validity & Reliability

The Patient Knowledge Assessment Questionnaire's validity and reliability were evaluated. For each element, the values revealed intra-class correlation coefficients more than 0.99. Internal validity was established in the current study using (2 tailed) 0.05 and internal consistency (r =0.89 p-value <0.001), while test re-test reliability using Cronbach's alpha was 0.89.

Tool III: Physical Activity Assessment Form: It was constructed by the researchers to assess physical activity among the study sample. It consists of nine statements regarding physical activities. These statements are expressed negatively (complaint or problem). Every statement has multiple replies on a Likert scale that ranges from five degrees of truth to never truth. The following was the scoring scheme. NT: Never true (5); RT: Rarely true (4), ST: Sometimes true (3); UT: Unusually true (2), AT: Always true (1).

Validity & Reliability

The Physical Activity Assessment Form's content validity was determined by the interrater (test-retest) reliability, which ranged from 0.95 to 0.98. The intra-class correlation coefficient was found to be between 0.75 and 0.87.

Tool IV: Lifestyle Modification Assessment Questionnaire: The researchers created this instrument to gauge how well patients were responding to the suggested changes in lifestyle. It is composed of 14 questions about activity (4 questions) and diet (10 questions). Every question contains five possible answers, ranging from 1 to 5, with a maximum score of 70 and a minimum score of 14.

Validity & Reliability

Using content validity and Pearson Product Moment correlation, the validity of the Lifestyle Modification Assessment Questionnaire was examined. P-value <0.001, internal consistency (r = 0.89), and significant 2-tailed 0.05 were used to determine the significant value.

Ethical Consideration

The Menoufia University Faculty of Nursing's Research Ethics Committee granted formal approval (894). Officials from the University hospital granted the outpatient clinic formal clearance after outlining the aim of the study and the procedure for collecting data. Patients provided their oral and written consent to participate in the study after being informed about it and assured that their information

would be kept private and used exclusively for that purpose. Through data coding, the researchers demonstrated that participation in the study was completely voluntary and that confidentiality was maintained. Their care would not be impacted if they choose not to participate.

Pilot study: A pilot study was conducted on eleven patients (10%) prior to data collection in order to evaluate the usefulness and clarity of the utilized tools; patients who had taken part in the pilot study were not included.

Procedure

Preparation phase:

- Following the submission of an official letter detailing the aim of the study and the data collection methods by the Dean of the Faculty of Nursing at Menoufia University, and the director of each setting officially authorized the research to be conducted.

- A plan for conducting the study was discussed with each setting's authorized individual.

- The researchers introduced themselves, the study's aim, and its design to the patients at the beginning.

- Following an explanation of the study's aim, patients gave their signed informed consent. The clarity of the study tools was assessed by a pilot study that involved eleven participants. These patients were not included in the final sample.

- The Demographic and Medical Data Form, Knowledge Assessment Questionnaire, Physical Activity Assessment Form, and Lifestyle Modification Assessment Questionnaire were the tools utilized to collect the required data for the study. These tools were used as a baseline assessment tools (pre-test) before patients' interventions. Structured interviews were conducted with all patients in the current study.

- Depending on the patient's education and cognitive ability, each interview lasted thirty to forty minutes.

Planning Phase:

- The diversified program was designed using patient data that was gathered. Objectives for the care were given great priority. A well-structured and colored booklet featuring pictures was designed and distributed to every patient as a reference for all relevant information related to the program.

- The booklet contains all the information needed about NAFLD, including its causes, symptoms, consequences, prevention, and management. It emphasizes diet, physical activity, and lifestyle modification. In addition, illustrations helped patients who were illiterate understand the instructions.

- Professionals in the field reviewed the material in this booklet to make sure it was accurate, understandable, and pertinent.

Implementation phase:

- The diversified program that included lifestyle modification, food guidance for weight loss, and exercise instructions was delivered to the patients. Three sessions were used for the study. Each session lasted from sixty to ninety minutes. The researchers created a WhatsApp application group to inform patients about the beginning and conclusion of each session attaching the related content (visual, gestural, spatial, and audio materials).

- Using visuals and booklet information, patients received information regarding NAFLD during the first session. Topics covered included diagnosis, risk factors, symptoms, prevention, complications, and management.

-A detailed explanation of diet, lifestyle modification, and weight management activities was provided in the second session. By following these guidelines, patients can modify their meals to fit their individual nutritional preferences. While the third session included suggestions for changing one's lifestyle and a regimen of moderate physical activity.

-Before introducing the new instructions, the researchers went over the previous ones at the beginning of each session. The researchers also gave patients the opportunity to raise any queries they might have and providing assistance with the program's execution.

- Following each patient's understanding of the provided instructions by the researchers, a follow-up via the WhatsApp group was conducted to ensure adherence to and retention of the instructions.

Evaluation phase:

- Every patient was evaluated using all the tools available, with an exception of the first one, by scheduling follow-up appointments for the initial assessment on the same day and a reassessment four weeks later (the shortest period of time that program results must appear on patient outcomes for evaluation).

Statistical analysis:

The data was analyzed using the Statistical Package of Social Science (SPSS) version 22, and the visualizations were created using Excel program. The mean, standard deviation (SD), and range were used to present quantitative data; percentages and numbers were used to provide qualitative data. Quantitative parameters were used to compare two comparable groups using a paired t-test. Chi- square test was used to investigate the statistical significant differences between the expected frequencies and observed ones. For all relevant indicators, the P-value of 0.05 was selected as the significance level.

Results:

Table (1) clarified that, most of the study sample were married, residing in rural areas, and their sitting time lasted more than 8 hours representing 89.4%, 87.5%, & 86.5% respectively. More than one half of them were males, had sedentary life, with a secondary education, and smokers representing 60.6%, 59.6%, 53.8%, & 54.8% respectively. While their age ranged between 30-62 years.

As seen from table (2a), it was obvious that there was statistical significant difference between pre and post intervention regarding weight (t= 4.23 & p <0.001), and BMI (t=1.88 & p=0.06). The average weight loss is 5.82% of the total body weight. More than two thirds of patients lost less than 10 % of their body weight post-intervention representing 68.3% respectively.

Table (2b) illustrated that there was statistical significant difference between pre and post intervention in relation to the interpretation of the two laboratory investigations results; ALP (t=2.56 & p=0.01), and GGT (t=3.03 & p=0.003). While high statistical significant differences were observed in the rest of laboratory investigations as well as in abdominal ultrasonography imaging results ($\chi 2$=92.20 & p<0.001).

Table (3) showed high statistical significant difference in the total mean score between pre and post-intervention in patients' responses regarding knowledge questionnaire (t=17.64 & p <0.001).

Figure (1) illustrated that 81.7% of patients in the pre-intervention period had good knowledge level and this percentage increased reaching 100% of patients in the post-intervention period.

Table (4) described that when comparing the pre and post- intervention periods it was clear that patients were complaining of more problems when performing physical activities in the pre intervention than in the post-intervention period. Significant improvement in patients' condition was observed post intervention in which no one had a continuous complain in all activities (0.00%) in the category of always true.

Figure (2) denoted that there was a statistical significant difference in the total mean score between the pre- (26.75) and post-intervention (49.64) regarding physical activity among the study sample (t=19.21& p<0.001).

Table (5) showed that statistical significant difference was observed between the pre and post intervention in all diet-related

lifestyle modification questions with an exception of the question regarding the frequency of eating pulses in which no statistical significant difference was found between pre and post intervention with a p value of 0.48. High statistical significant differences were found regarding the four questions related to exercises with a p value <0.001.

Figure (3) illustrated that there was a significant improvement in patients' response with a total mean score of 35.97 post-intervention compared to 34.85 pre-intervention. Statistical significant difference was found between total mean scores in pre and post-intervention regarding diet & exercises related-lifestyle modification (**t**=2.14 & p=0.03)

Table (1):Frequency and Percentage Distribution of Demographic Characteristics and Medical Data among the Study Sample (n=104)

Demographic characteristics	**NO.**	**%**
Age (years):		
Mean±SD	44.20 ± 8.0	
Range	30.0 – 62.0	
Gender:		
Male	63	60.6
Female	41	39.4
Marital status:		
Single	5	4.8
Married	93	89.4
Widow	6	5.8
Occupation		
Needs physical activity	10	9.6
Needs mental activity	32	30.8
Sedentary	62	59.6
Education:		
Primary	42	40.4
Secondary	56	53.8
University	6	5.8
Residence:		
Urban	13	12.5
Rural	91	87.5
Smoking:		
Smoker	57	54.8
Non smoker	47	45.2
Sitting Time		
≤ 8 hours/day	14	13.5
>8 hours/day	90	86.5

Table (2a): Body Mass Index (BMI) Measures and Weight Loss Percentage Distribution among the Study Sample Pre- and Post- Intervention (n=104)

	Pre-intervention	Post-intervention	Paired t test	P value
	Mean ±SD Range	Mean ±SD Range		
Weight	88.68±11.91 72.0 – 110.0	83.52±7.55 70.0 – 105.0	4.23	<0.001**
BMI	30.92±3.23 27.0 – 37.0	30.25±2.97 26.09 –36.36	1.88	0.06*
Average percent of weight loss		5.82%		
Percent of weight lost <10% weight loss ≥10% weight loss		**N (%)** 71 (68.3) 33 (31.7)		

** highly significant * significant

Table (2b): Laboratory Investigation and Diagnostic Test Results Pre- and Post- Intervention among the Study Sample (n=104)

	Pre-intervention	Post-intervention		
	Mean ±SD Range	Mean ±SD Range		
Laboratory Investigations				
Triglycerides (TG)	150.94±16.15 100.0 – 175.0	112.66±14.43 90.0 – 150.0	23.78	<0.001 **
Alkaline phosphatase (ALP)	119.23±9.77 100.0 – 150.0	118.83±8.88 100.0 – 144.0	2.56	0.01 *
Alanine aminotransferase (ALT)	49.80±16.01 30.0 – 80.0	32.95±6.47 25.0 – 55.0	12.70	<0.001 **
Aspartate Transaminase (AST)	45.09±12.82 30.0 – 80.0	31.01±4.94 20.0 – 42.0	14.05	<0.001 **
Gamma-glutamyle Transferase (GGT)	49.57±10.61 30.0 – 70.0	48.91±10.41 30.0 – 70.0	3.03	0.003 *
Diagnostic Test				
Abdominal Ultrasonography **Abd. U/S N(%)** Bright liver Normal Coarse liver	 100 (96.2) 2 (1.9) 2 (1.9)	 37 (35.6) 67 (64.4) 0 (0.0)	$\chi 2$= 92.20	<0.001 **

** highly significant * significant

Table (3): Patients' Knowledge Regarding NAFLD and its Diet- related Data Pre- and Post-Intervention among the Study Sample (n=104)

Variable	Pre-intervention			Post-intervention		
	Wrong or don`t know N(%)	Correct and incomplete N(%)	Correct and complete N(%)	Wrong or don`t know N(%)	Correct and incomplete N(%)	Correct and complete N(%)
Definition	17 (16.3)	77 (74.0)	10 (9.7)	0 (0.0)	5 (4.8)	99 (95.2)
Causes	0 (0.0)	61 (58.7)	43 (41.3)	0 (0.0)	6 (5.8)	98 (94.2)
Manifestations	9 (8.7)	41 (39.4)	54 (51.9)	0 (0.0)	0 (0.0)	104 (100.0)
Complications	30 (28.8)	20 (19.2)	54 (51.9)	0 (0.0)	0 (0.0)	104 (100.0)
Preventive measures	5 (4.8)	0 (0.0)	99 (95.2)	0 (0.0)	0 (0.0)	104 (100.0)
Food Alleviating its manifestations	0 (0.0)	7 (6.7)	97 (93.3)	0 (0.0)	4 (3.8)	100 (96.2)
Drinks Alleviating its manifestations	5 (4.8)	0 (0.0)	99 (95.2)	0 (0.0)	0 (0.0)	104 (100.0)
Foods aggravating the manifestations	0 (0.0)	6 (5.8)	98 (94.2)	0 (0.0)	0 (0.0)	104 (100.0)
Total score Mean ±SD Range	12.69 ± 1.86 9.0 – 15.0			15.85 ± 0.35 15.0 – 16.0		
Paired t test (P value)	17.64 (p<0.001 **)					

** highly significant

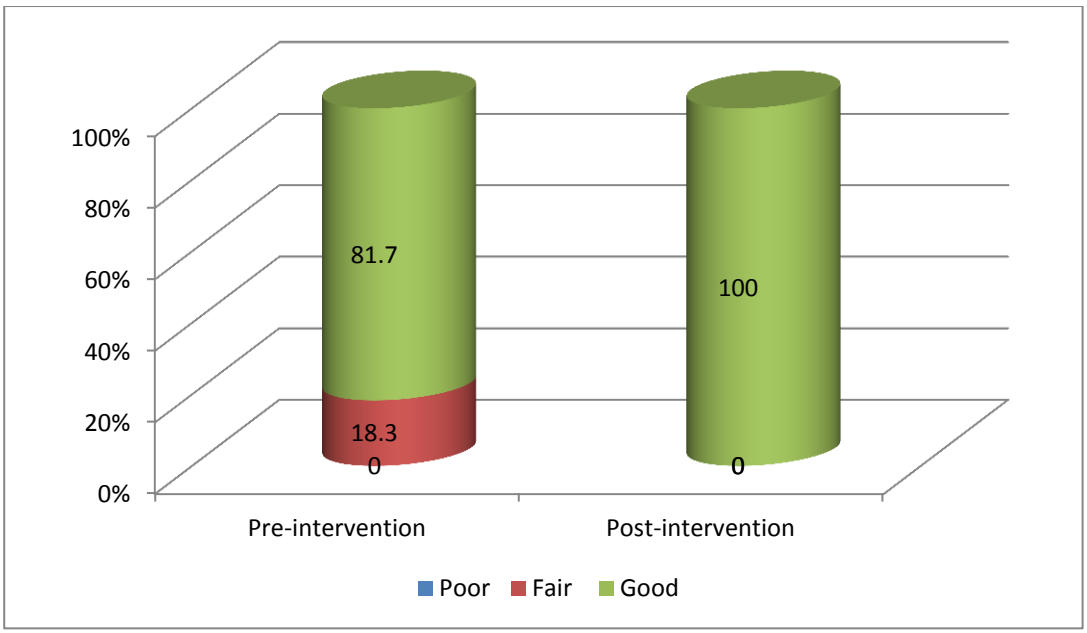

Figure 1: Frequency and Percentage Distribution of Knowledge Level Pre & Post-Intervention among the Study Sample (n-104)

Table (4): Frequency & Percentage Distribution regarding Physical Activity Assessment Pre- and Post- Intervention among the Study Sample (n=104)

	Pre-intervention					Post-intervention				
	AT N (%)	UT N (%)	ST N (%)	RT N (%)	NT N (%)	AT N (%)	UT N (%)	ST N (%)	RT N (%)	NT N (%)
Picking up objects	6 (5.8)	35 (33.7)	59 (56.7)	3 (2.9)	1 (0.9)	0 (0.0)	0 (0.0)	34 (32.7)	64 (61.5)	6 (5.8)
Tying shoes	0 (0.0)	50 (48.1)	50 (48.1)	4 (3.8)	0 (0.0)	0 (0.0)	0 (0.0)	34 (32.7)	67 (64.4)	3 (2.9)
Using stairs	0 (0.0)	42 (40.4)	50 (48.1)	12 (11.5)	0 (0.0)	0 (0.0)	0 (0.0)	36 (34.6)	57 (54.8)	11 (10.6)
Putting on clothes	0 (0.0)	67 (64.4)	25 (24.1)	12 (11.5)	0 (0.0)	0 (0.0)	5 (4.8)	43 (41.3)	47 (45.2)	9 (8.7)
Ankles swollen by the end of day	26 (25.0)	40 (38.5)	26 (25.0)	12 (11.5)	0 (0.0)	0 (0.0)	14 (13.5)	33 (31.7)	47 (45.2)	10 (9.6)
Shortness of breath with mild exertion	0 (0.0)	49 (47.1)	51 (49.1)	3 (2.9)	1 (0.9)	0 (0.0)	9 (8.6)	25 (24.1)	57 (54.8)	13 (12.5)
Painful or stiff joints	3 (2.9)	12 (11.5)	77 (74.1)	10 (9.6)	2 (1.9)	0 (0.0)	0 (0.0)	43 (41.3)	42 (40.4)	19 (18.3)
Inability to perform moderate exercises	3 (2.9)	66 (63.5)	23 (22.1)	10 (9.6)	2 (1.9)	0 (0.0)	0 (0.0)	30 (28.8)	55 (52.9)	19 (18.3)
Inability to perform Vigorous exercises	9 (8.7)	14 (13.5)	64 (61.5)	15 (14.4)	2 (1.9)	0 (0.0)	9 (8.7)	37 (35.5)	35 (33.7)	23 (22.1)

NT: Never true; RT: Rarely true, ST: Sometimes true; UT: Unusually true, AT: Always true

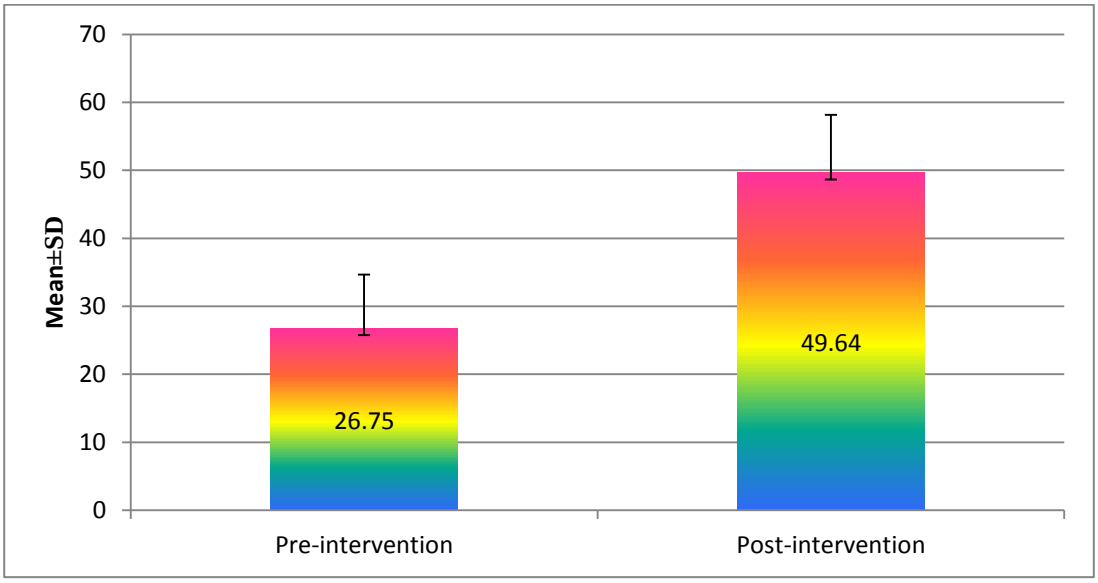

Figure 2: Total Mean Score of the Physical Activity Pre- and Post- Intervention among the Study Sample(n=104)

Table (5): Patients' Response Regarding Diet & Exercise Related-Lifestyle Modification Pre- and Post- Intervention among The Study Sample (n=104)

	Pre-intervention (n=104)		Post-intervention (n=104)		χ^2	P value
	No.	%	No.	%		
Number ofmeals/days						
More than three	38	36.5	90	86.5	54.92	<0.001
Three or less	66	63.5	14	13.5		**
Frequency of drinking tea/day						
More than six times	66	63.5	53	51.0	11.76	0.008
Five times or less.	13	12.5	18	17.3		*
Three times or less.	22	21.2	17	16.3		
Twice or less	3	2.8	16	15.4		
Frequency of drinking coffee/day						
Five times or less.	39	37.5	37	35.6	11.18	0.003
Three times or less.	54	51.9	64	61.5		*
Twice or less	11	10.6	3	2.9		
Frequency of drinking sweetened beverages						
At least once/day	0	0.0	5	4.8	15.65	<0.001
One to two times / week	1	1.0	12	11.5		**
Two to three times / week	103	99.0	87	83.7		
Frequency of eating fruits						
At least once / day.	10	9.6	24	23.1	6.89	0.008
Three to four times / week.	94	90.4	80	76.9		*
Frequency of eating salad						
At least once / day.	3	2.9	58	55.8	70.16	<0.001
Three to four times / week.	101	97.1	46	44.2		**
Frequency of eating green vegetables						
At least once / day.	9	8.7	74	71.2	84.70	<0.001
Three to four times/week.	95	91.3	30	28.8		**
Frequency of eating pulses						
At least once/ day.	18	17.3	22	21.2	0.49	0.48
Three to four times/ week.	86	82.7	82	78.8		
Frequency of eating saturated fats						
At least once/ day.	66	63.5	26	25.0	31.18	<0.001
Three to four times/ week	38	36.5	78	75.0		**
Frequency of eating baked goods						
At least once/ day.	64	61.5	49	47.1	4.35	0.04
Three to four times/ week	40	38.5	55	52.9		*
Frequency of adding margarine and butter						
At least once/ day.	88	84.6	12	11.5	111.24	<0.001
Three to four times/ week	16	15.4	92	88.5		**
Frequency of eating junk foods						<0.001
One to two times /week.	73	70.2	22	21.2	50.39	**
Once / month	31	29.8	82	78.8		
Frequency of eating proteins						<0.001
Once / month.	2	1.9	0	0.0	22.03	**
Three to four times/ week	61	58.7	30	28.8		
At least once/ day	41	39.4	74	71.2		
Practicing sport					18.30	<0.001
Yes	67	64.4	93	89.4		**
No	37	35.6	11	10.6		
Type of sport						
Walking	64	61.5	81	77.8	28.07	<0.001
Bicycle	3	2.9	11	10.6		**
Walking and bicycle	0	0.0	1	1.0		
No	37	35.6	11	10.6		
Frequency of doing exercises						
Once /week	18	17.3	3	2.9	36.89	<0.001
One to two times/week.	49	47.1	90	86.5		**
Three to four times/ week	37	35.6	11	10.6		
Duration of exercise per session						<0.001
More than 40 minutes	0	0.0	17	16.3	44.90	**
20-30 minutes.	47	45.2	71	68.3		
Less than 10 minutes.	57	54.8	16	15.4		

** highly significant * significant

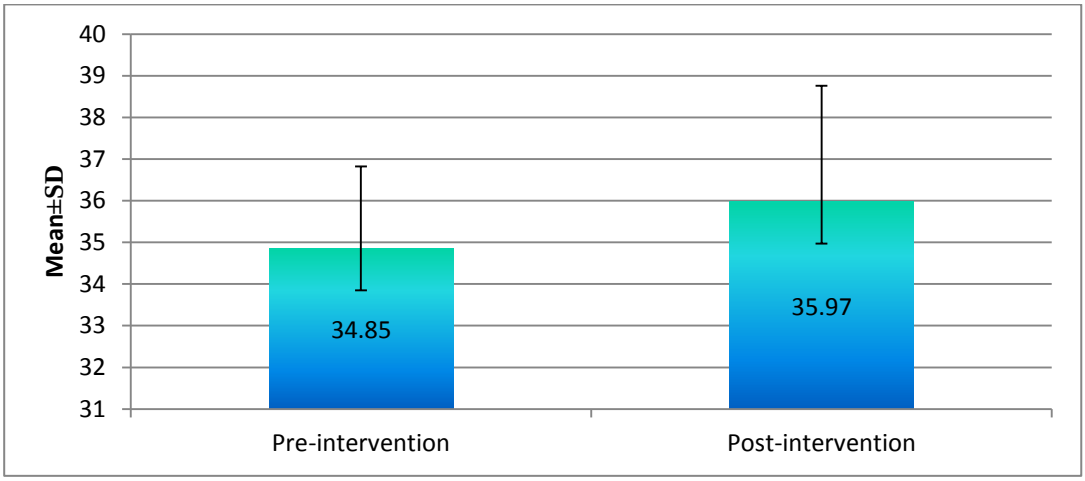

Figure 3: Total Mean Scores of Patients' Response to the Recommended Lifestyle Modification Pre- and Post- Intervention among the Study Sample (n=104)

Discussion

Being overweight, eating an unhealthy diet, and not exercising are primarily associated with NAFLD. When there are no authorized pharmaceutical interventions, dietary changes, and increasing physical activity to facilitate weight loss are all parts of the suggested lifestyle modification therapy. Despite this, there is a dearth of information regarding the use of lifestyle therapy in clinical settings, including what it should entail, how it should be administered, and whether it can be done so in a way that makes it feasible to be incorporated into routine care **(Pintó, et.al., 2019).** The evidence supporting lifestyle modification among obese patients with NAFLD is highlighted in this study.

Results from the current study revealed that most patients were married, lived in rural areas, and spent more than eight hours in the sitting position. Moreover, they had a secondary education, having a sedentary lifestyle, and smokers, while over half of them were men. Their ages varied from 30 to 62 years old (mean age of 44), obese with a BMI of 30kg/m2, and suffered from elevated liver function test results. Supporting these findings was study conducted by **Alswat, et al. (2021)** to identify the clinical and metabolic characteristics of NAFLD patients in Saudi Arabia, and found that the age group of 31 to 60 years old had the highest frequency. It happened to men more often than to women. Overweight or obesity was present in over half of the patients, and central obesity affected around two thirds of them. While the level of alanine amino-transferase (ALT) was higher than the upper limit of normal in over one-third of the cases.

Regarding smoking, there is a debate concerning the link between smoking and NAFLD. Globally, smoking is a significant risk factor for the onset of chronic, non-communicable diseases (NCD) like cancer, type 2 diabetes, respiratory disorders, and cardiovascular disorders **(Ou, Fu, Liao, Zheng & Wu, 2019)** . While, the histological severity was observed to be elevated by cigarette smoking among obese patients with NAFLD. The proportion of patients with advanced and substantial liver fibrosis among smokers was found to be significantly higher than that of non-smokers in a cross-sectional analysis of NAFLD patients both smokers and non-smokers **(Rezayat, 2018).** A meta-analysis and comprehensive review of 20 published studies performed to assess the relation between smoking and NAFLD showed a strong correlation between them, and suggested more research to elucidate the underlying processes of this link. Contrary to these studies was a cross-sectional study to investigate the prevalence of NAFLD among 933 patients (368 smokers and 565 non-smokers as controls), revealed no difference between the two groups

(22.2% versus 29%), nor with heavy smokers (> 20 packs of cigarettes per year) **(Al-Dayyat, Rayyan, &Tayyem, 2018).**

The sitting time for most of the current study subjects lasted for more than eight hours. Supporting this result was a study conducted by **Atri, et.al. (2020),** to examine the predictors of non-alcoholic fatty liver disease in morbidly obese women, showed that up to 9–10 hours a day are spent sitting down by overweight and obese NAFLD patients. In contrast to short sitting times (<4 h/d), long sitting times (>8 h/day) nearly double the risk and raise the incidence of increased liver fats by 10–20%. While more studies were recommended in this area, reducing inactive time without increasing physical exercise may also help reduce the severity of NAFLD.

In the current study, statistical significant difference was observed between pre- and post-intervention regarding laboratory investigation test results with an average weight loss of 5.82% of the total body weight. In addition, more than two-thirds of them lost less than 10% of their body weight post-intervention. A study including twenty-five Japanese adults by **Colca & Scherer (2021),** examining the effect of obesity on chronic liver diseases, illustrated that the majority of NAFLD patients received weight loss instructions as a main line of treatment protocol. Moreover, weight loss can improve liver biochemical tests, liver histology, blood insulin levels, and quality of life. Aminotransferases, triglycerides, cholesterol, alkaline phosphates (ALP), and fasting glucose considerably improved following one month of combined exercise and dieting therapy. The findings of another study conducted by **Carlsson, et al. (2020),** to assess life expectancy of 48 obese patients with NAFLD, was supported by the observation that most of patients who lost less than 10% of their body weight had improved liver biochemistry and that half of them had fully normalized the profiles.

Contradicting the results of the current study was the study conducted by **Hallsworth, & Adams (2019),** demonstrated that serum indicators such as aminotransferases (AST, ALT) are mildly to moderately increased after any laboratory testing. Nevertheless, in patients with NAFLD or associated disorders, the AST and ALT values may be nonspecific. stated differently; increased or normal AST and ALT levels do not imply the presence of NAFLD. In addition, elevations of ALT are more prevalent than AST in patients with NAFLD. When compared to ordinary steatosis, NASH typically has higher ALT levels.

The current study findings revealed statistical significant difference between pre and post-intervention regarding diagnostic test results. Ultrasonography (US) imaging presented a bright liver appearance in most of the study subjects pre-intervention and the number of these subjects decreased dramatically post-intervention to reach less than half of them. Supporting this result was the study conducted by **Ampong, et.al. (2020),** investigating the effect of dietary insufficiency in fatty liver disease, clarified that, due to diffuse fatty infiltration, the US frequently shows a bright liver or a hyperechoic texture. When it comes to identifying increasing fibrosis and steatosis, the US has a sensitivity and specificity of 89 and 93%, respectively. Nonetheless, the US approach is the least expensive and the most often utilized modality in clinical practice. Patients who are obese have lower US sensitivity. Steatosis is suggested by the US if it reveals hyperechogenic liver tissue in comparison to the spleen or renal echogenicity. But in these patients, the US's sensitivity is only 60–94%.

Significant improvement in patients' knowledge level regarding NAFLD was observed in the current study with a statistical significant difference in total mean score between pre and post-intervention. In a study by **Arora, et.al (2021),** to determine the degree of awareness among patients with NAFLD, the majority of patients believed that the prevalence of NAFLD was between 10 and 40 percent, while over three-quarters of them saw NAFLD as a serious health issue. Most patients were aware of the three risk factors for NAFLD: obesity, dyslipidemia, and diabetes mellitus.

Another study was performed by **Carneros, López & Bustos (2020),** to examine the physiopathology of lifestyle intervention

among NAFLD, and 29 patient interviews conducted in total. This study showed that, most patients knew that the mainstays of weight loss therapy were diet and exercise, but they frequently had questions regarding the nature and diagnosis of their liver illness. The majority of patients exhibited no worry about their prognosis, had no symptoms, and were accidently diagnosed.

Statistical significant difference was found between pre and post-intervention regarding all diet and exercise-related lifestyle modification questions response with the exception of only one question. It is obvious that more than half of the study subjects drink coffee three times per day. According to a study providing an overview about NAFLD by **Bugianesi (2020),** showed that, strong antioxidants like caffeine may have a hepato-protective impact by lowering the load of oxidative stress and inflammation in the liver. The study also found that, drinking coffee improves liver enzymes in people who are at risk of liver disease, and consuming more than three cups of coffee per day, but not less than two cups, clearly had a protective effect.

According to a study conducted to determine the epidemiology of NAFLD by **Younossi, Marchesini, Pinto & Petta (2019),** revealed that a Mediterranean diet, which is characterized by a reduction in the consumption of carbohydrates (particularly sugars and refined carbohydrates) and an increase in the consumption of vegetables and fruits, can help manage NAFLD by reducing liver fat. Long-term sugary drink and red meat use were positively correlated with NAFLD. While, **Ghosal , Datta & Sinha, (2021)** stated that, although there has been much research on the prevention and management of non-alcoholic fatty liver disease (NAFLD), the consequences of dietary consumption of protein have not received as much attention as sugary drinks.

According **to Kaul, et.al. (2020),** who examined the safety and efficacy of bariatric surgery among obese patients with NAFLD, liver enzymes and histological alterations are improved by 5% and 7% loss of total body weight. The study also showed that losing weight was linked to improvement in ALT, AST, and GGT within the study group after one month (7.1% weight loss) and three months (9.7% weight loss) follow-up. However, in the control group, only 2% weight loss within three months was linked to improvements in ALT and AST. In these patients, weight loss without returning to normal BMI was connected with a decrease in liver enzymes. Although the exact cause of this discovery is unknown, it could be connected to modifications in dietary components or eating patterns, physical activity and lifestyle.

Similar results were observed in a study about diet therapy for NAFLD by De Chiara, **Ureta & Ramón (2019),** it showed that the hazardous condition known as fatty liver disease is brought on by the strain that excess weight places on the liver. Obesity is associated with an increased risk of fatty liver disease. The current best course of action for treating fatty liver disease is losing 7 to 10% of body weight. Patients are able to safely and effectively change their lifestyle practices by combining physical exercise with diet. It also showed evidence that altering unhealthy living choices can lower transaminase levels and potentially improve NAFLD.

Speaking in the same line were **Albhaisi, Chowdhury & Sanyal (2019),** who stated that for obese patients with NAFLD, weight loss is still the mainstay of treatment as there is currently no approved medication therapy. A 25% decrease in liver fat can occur along with a 5% BMI drop. Physical activity (PA) and diet are complementary but separate strategies for losing weight. The prevailing belief is that all obese NAFLD patients are both undernourished and underactive. Combined, the diet and PA components show a significant variance in lifestyle adequacy in their study.

In summary, it's interesting to highlight that obese patients with NAFLD should be encouraged to lead a healthy lifestyle that goes beyond weight loss, regardless of whether or not they are obese. It is believed that consuming a healthy diet that lowers the number of calories, improves fiber consumption, and engages in regular exercise will have a positive impact.

Conclusion

The current study findings revealed statistical significant difference between pre and post-intervention regarding knowledge level, body weight, body mass index, laboratory and diagnostic test results as well as diet &exercise-related lifestyle modification. So, the diversified program could be considered an efficient approach for the resolution of existing fatty liver, prevention of new fat development, improvement in patient's lipid profile, body weight, liver function and liver enzymes, and modification of lifestyle practices.

Recommendations

-The study should be replicated on a larger probability sample from a different region.

-The diversified NAFLD program should be generalized under the supervision of organizational policies.

- Authorized individuals should increase public awareness of the diversified NAFLD program through the media.

-Nurses should receive ongoing and periodic training regarding NAFLD prevention, control, diet, exercise, and lifestyle modification measures.

-Patients in outpatient clinics should receive a colorful booklet outlining the content of the diversified program.

-Patients should be motivated to modify their unhealthy lifestyle practices, and social support is curricular.

-It is important to bridge the knowledge gap through patient's education regarding the disease.

- Future studies addressing the unresolved questions about the connection between fatty liver and the progression of fibrosis ought to be available shortly.

-Future studies are crucial to ascertain the precise mechanisms by which certain diet and exercise regimens could manage each stage of liver disease.

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