ORIGINAL ARTICLE

The outcome of health belief model-based dietary counselling in metabolic-associated fatty liver disease patients

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Abstract

Background: ***Metabolically associated fatty liver disease (MAFLD) prevalence is among the highest in Egypt, with over one-third of the population affected, compared to a global prevalence of approximately 25 percent. Changing lifestyle is proven to be the most beneficial treatment for this disease.***

Aim of the study: ***This study aims to evaluate the efficacy of a month-long intervention program for HBM model-based dietary counseling for patients with metabolic-associated fatty liver disease (MAFLD).***

Methodology: ***A quasi-experimental design was applied for this study. A suitable sample of 61 MAFLD patients who agreed to join the study was utilized. The study variables were four sectioned questionnaires, namely (demographic, adherence to dietary recommendations, knowledge, and health beliefs), anthropometric measurements, liver enzymes, lipid profile, and fatty liver grades. All study variables were assessed and gathered both before and after the four-month intervention.***

Results: ***After four months of intervention, significant improvements in health belief model (HBM) variables and knowledge were seen ($p < 0.0001$). Additionally, significant reductions in anthropometric measurements, liver enzymes, and lipid profiles were observed. Likewise, fatty liver index and ultrasonographic findings revealed a significant improvement.***

Conclusions: ***The application of dietary counseling based on the health belief model can greatly enhance MAFLD patients' health beliefs and knowledge, resulting in preventing or even reversing MAFLD progression.***

Keywords: Metabolic-associated fatty liver disease (MAFLD); Health Belief Model (HBM); Obesity; Education; Behavior change

1. Introduction

Over the last five decades, the Egyptian population's eating pattern has seen an overall increase in energy consumption. Red meat, processed foods, vegetable oils, fast food, and soft drinks have replaced fresh fruits and vegetables in their diet .[1] Metabolically associated fatty liver disease (MAFLD), previously referred to as nonalcoholic fatty liver disease (NAFLD), has become more prevalent concurrently with the aforementioned changes, resulting in a significant clinical and financial burden. Based on available data, MAFLD prevalence is among the highest in Egypt, with over one-third of the population affected, compared to a global prevalence of approximately 25 percent .[2-4] MAFLD can develop into steatohepatitis, a significant risk factor for HCC and cirrhosis .[5] Currently, MAFLD is steadily rising to be the leading cause of hepatocellular carcinoma (HCC) worldwide. (6). Based on available data, Egypt has experienced one of the largest increases in the age-standardized incidence rate of MAFLD-related HCC worldwide, rising by 89.8% between 1990 and 2017 .[6]

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In the 1950s, the Health Belief Model (HBM) was created to promote health behaviors. The model emphasizes a person's perceptions and beliefs about a specific health problem, which are important in influencing their behavior and, consequently, the improvement of that health problem .[7] The core concept of (HBM) is that a person's beliefs or perceptions about MAFLD impact their health behavior, which is composed of six constructs, namely: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy .[8,9]

Despite researchers having addressed using HBM on Egyptian patients with various illnesses.[10, 11] as far as we are aware, there are no studies on the efficacy of HBM on Egyptian MAFLD patients. So, this quasi-experimental study was carried out to evaluate the efficacy of health belief model-based dietary counseling on knowledge & health belief domains, anthropometric measurement, Biochemical blood parameters, and liver steatosis.

The aim of the study is to determine whether the utilization of HBM will enhance MAFLD patients' knowledge and beliefs, which in turn will improve their steatosis score.

2. Patients and methods

This was a quasi-experimental study measuring the efficacy of HBM-based dietary counseling on Egyptian MAFLD patients. From February 2023 to June 2024, subjects were evaluated in the therapeutic Nutrition Clinic of the Department of Hepatology and Gastroenterology, National Liver Institute (NLI) Hospital, Menoufia University, Egypt. The inclusion criteria were: MAFLD diagnosis by a qualified physician (the presence of bright liver by ultrasound in addition to fulfilling one of the subsequent criteria: Type 2 diabetes mellitus (DM), obesity, or signs of metabolic dysregulation) (12), aged 20 to 70 years old; having a BMI of 25 or above, not drinking alcohol, and being willing to volunteer in the study. The exclusion criteria were missing over two education sessions, losing weight in the previous six months, going through menopause, pregnancy, or breastfeeding. After explaining the study aims, questionnaires were distributed to the participants who agreed to participate in the study (N= 61), and they were asked to fill them out. The researcher discussed all the details with the patients, and their written consents were obtained. The researcher clarified that all patients had the option to withdraw at any moment, and their identities and privacy were greatly respected. The study protocol was authorized by the Institutional Review Board of the National Liver Institute (NLI), Menoufia University, Egypt (ethic number: 00555/2024).

Based on the literature, the total score of Patients' Beliefs improved after HBM-based dietary counseling with an effect size (Cohen's d) of 4.44 (10), taking into account potential loss to follow-up. We got the sample size of 61 provided that α error probability(err prob) = 0.05 & Power (1-β err prob) = 0.8 (13).

Patients participated in HBM-based dietary counseling. For a period of four months, MAFLD patients attended nutritional counseling sessions every two weeks. Table 1 illustrates each session's objectives as well as the items of content included in every session.

The study's primary outcome was that knowledge and health belief scores improved between before and four months after the intervention. The study's secondary outcome was that biochemical blood parameters, anthropometric measurements, and the Steatosis score improved between before and four months after the intervention.

All study variables were assessed and gathered both before and after the four-month intervention. The self-administered questionnaire had been evaluated by 3 experts, and its content was edited according to their comments. Fifteen participants who were similar to our intervention sample were tested and retested at two-week intervals to determine the scale's reliability. The questionnaire's total Cronbach's alpha was 0.797, which is acceptable.

There were four sections on the questionnaire. The first section covered demographic data. The second section was Nine questions about Adherence to dietary recommendations. The third section was ten questions about knowledge about the causes & diagnosis of MAFLD. "Correct" was assigned a score of one, while "incorrect" and "I don't know" were assigned a score of zero.

The fourth section is the HBM scale. Scale design was carried out by conducting a small-scale qualitative study on health beliefs about MAFLD and lifestyle modification. Twenty MAFLD patients with diverse characteristics participated in order to ensure that participants came from a wide range of demographic backgrounds. In order to find out whether the subjects were familiar with the constructs of HBM, a series of questions was first posed. For instance, regarding the perceived benefits of lifestyle modification, the participants were asked if they knew the benefits of lifestyle modification. Then, answers were collected, analyzed and selected as sentences for each construct of HBM. After developing the first draft, it was discussed several times. The bottom line is a set of 20 sentences that was created and used, divided as follows: Perceived susceptibility to MAFLD (6 sentences), perceived severity of MAFLD

(1 sentence), perceived benefits of lifestyle modification (4 sentences), Perceived barriers of lifestyle modification (3 sentences), and Self-efficacy for lifestyle modification (6 sentences). The scoring system was a 5-point Likert scale from totally agree to totally disagree for all constructs except for self-efficacy, which had responses ranging from never to always with scores of 1–5.

After fasting for the entire night and wearing very little clothing and no shoes, body weight was measured to the closest 0.1 kg. We measured height to the closest 0.1 cm. BMI was computed by dividing height in meters squared by weight in kilograms. Blood samples (10 mL) were collected after twelve hours of overnight fasting. The laboratory standard value of aspartate aminotransferase (AST) is 10-34 (U/L), alanine aminotransferase (ALT) is 10-44 (U/L), gamma-glutamyl transferase (GGT) is 11-50 (U/L), Serum Albumin is 3.5-5 (g/dl), Total Cholesterol is 125-200 (mg/dl), triglycerides (TG) is 60-160 (mg/dl), low-density lipoprotein (LDL) is 91-180 (mg/dl), high-density lipoprotein (HDL) is 35-65 (mg/dl) and HbA1c is 4.2-6.2 (%).

According to (Fouad et al., 2022) (14), numerous steatosis simple scores have been proposed as an alternative method to MRI-based techniques for the assessment of hepatic steatosis, particularly in large-population studies. In particular, the Fatty Liver Index (FLI), which is based on BMI, waist circumference, TGs, and GGT, has been recently validated in 15 a large cohort of 35,335 patients with MAFLD. So, we selected FLI as an indicator for steatosis improvement. Using ultrasonography, the grade of liver steatosis was determined as follows: (score 0) when the liver's echotexture is normal; (score 1) when there is a slight and diffuse increase in liver echogenicity with normal visualization of the diaphragm and the portal vein wall; (score 2) when there is a moderate increase in liver echogenicity with slightly impaired appearance of the diaphragm and the portal vein wall; and (score 3) when there is a marked increase in liver echogenicity with poor or no visualization of the portal vein wall, diaphragm, and posterior portion of the right liver lobe.

For statistical analysis, data have been collected and input into a computer using the SPSS (Statistical Package for Social Science) program (version 20; Inc., Chicago, IL). Means and standard deviations were applied to quantitative data that had a normal distribution. Frequency and percentage were used for qualitative data. The paired-sample t-test was applied to compare the means of the groups before and after the intervention. The value of P<0.05 was considered statistically significant.

3. Results

Sixty-one MAFLD patients were assessed. The baseline characteristics, including age, gender, residence, occupation, education, marital status, and presence of diabetes and hypertension are shown in (Table 2).

After four months of HBM-based dietary counseling, significant improvements in all the HBM variables (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy), total HBM score, and total knowledge score were seen ($p < 0.0001$) (Table 3).

With regard to anthropometric measurements, a strong significant reduction in Weight, BMI, and Waist circumference was observed ($p < 0.0001$). Similarly in Liver Function tests, a strong significant reduction in ALT, AST, and GGT was observed $p < 0.0001$. However, a less significant Albumin reduction was observed at 0.002. Also, regarding lipid profile, a strong significant reduction in Cholesterol, Plasma triglycerides, and Plasma LDL was observed ($p < 0.0001$) (Table 4).

The mean of Faty liver index after dietary counseling was 65.56 ± 21.51 which was significantly lower than before the dietary counseling 84.64 ± 14.85 $p<0.0001$. Similarly, ultra-sonographic findings revealed the percentage of patients who had no fatty liver by ultra-sonography after dietary counseling was 41%, which was significantly higher than before dietary counseling 0% $p<0.0001$ (Figure 1, 2).

Multiple regression analysis was used to examine the predictors of fatty liver index improvement (table 4). HBM-based dietary counseling was found to be an important predictor for fatty liver index improvement specifically Perceived severity and Perceived Self-efficacy. The overall model explains 88.3% variation of Faty liver index improvement, and it is significantly useful in explaining Faty liver index improvement, $F = 57.5$, $p< 0.0001$ with regression equation that:

Fatty liver index improvement = 313.52 -1.314 (age) + 2.287 (Perceived severity mean difference) + 0.996 (Self-efficacy mean difference) - 5.424 (HTN) - 37.136 (DM) -2.014 (BMI baseline) -0.388 (Plasma LDL baseline) -15.288 (HA1c baseline)

Table 1. Lesson plan for HBM-based dietary counseling

SESSION TITLE	CONTENT
FIRST & SECOND SESSION GOAL: INCREASING THE PERCEIVED SUSCEPTIBILITY AND	- Familiarizing individuals with MAFLD causes and methods of diagnosis. - Educating people about MAFLD's prevalence in Egypt. - Talking on complications of MAFLD. - Discussing treatment & follow-up options

SEVERITY OF MAFLD	of MAFLD patients.
THIRD & FOURTH SESSION	- Describing the advantages one gets from adhering to healthy nutrition.
GOAL: IMPROVING THE PERCEIVED BENEFITS AND REDUCING THE PERCEIVED BARRIERS	- Talking about the obstacles and barriers to adhering to healthy nutrition.
FIFTH & SIXTH SESSION	-Total calories allowed per day and how to calculate it according to the ideal or adjusted weight.
GOAL: INCREASING SELF-EFFICACY AND CUES TO ACTION	-Introducing the food pyramid.
	- Explaining the Mediterranean Diet and how to apply it.
SEVENTH & EIGHTH SESSION	- Explaining sugar, sweets & sugar-sweetened products.
GOAL: INCREASING SELF-EFFICACY AND CUES TO ACTION	- Explaining of exchange list and food groups
	- A brief explanation of the medical treatment of MAFLD.

Table 2. Descriptive characteristics of the sample studied.

VARIABLE		NO (%) (N=61)
AGE (YEARS)	25-40 41-55 56-70	13 (21.3%) 39 (63.9%) 9 (14.8%)
	Mean ± SD Range	47.1 ± 9.1 years (29 – 65) years
GENDER		
MALE		22 (36.1%)
FEMALE		39 (63.9%)
RESIDENCE		
RURAL		35 (57.4%)
URBAN		26 (42.6%)
OCCUPATION		
NOT WORKING		30 (49.2%)
EMPLOYEE		21 (34.4%)
SELF-EMPLOYED		10 (16.4%)
EDUCATION		
DOES NOT READ OR WRITE		12(19.7%)
BASIC EDUCATION		13(21.3%)
INTERMEDIATE EDUCATION		22(36.1%)
HIGHER EDUCATION		14(23.0%)
MARITAL STATUS		
MARRIED		45 (73.8%)
WIDOWED		12 (19.7%)
DIVORCED		4 (6.6%)
HTN		
NO		50 (82.0%)
YES		11 (18.0%)
DM		
NO		32 (52.5%)
YES		29 (47.5%)

Mean ± SD: (mean± standard deviation), No: number.

Table 3. Efficacy of dietary counseling on Knowledge and HBM domains.

VARIABLES	BEFORE	AFTER	% OF CHANGE	TEST OF SIGNIFICANCE	P VALUE
PERCEIVED SUSCEPTIBILITY	13.75 ± 4.24 6-22	24.34 ± 4.28 16-30	77.02%	Paired t 12.9	<0.0001*
PERCEIVED SEVERITY	1.84 ± 0.79	3.82 ± 1.41	107.6%	Paired t 11.4	<0.0001*
PERCEIVED BENEFITS	9.62 ± 3.02 4-12	19.21 ± 1.52 16-20	99.7%	Paired t 26.03	<0.0001*
PERCEIVED BARRIERS	5.05 ± 2.49 3-9	11.91 ± 3.03 3-15	135.8%	Paired t 12.5	<0.0001*
SELF-EFFICACY	10.51 ± 3.98 6-18	26.48 ± 3.57 18-30	151.95%	Paired t 29.5	<0.0001*
TOTAL HBM SCORE	40.77 ± 7.92 31-60	85.77 ± 8.35 69-100	110.4%	Paired t 32.8	<0.0001*
TOTAL KNOWLEDGE SCORE	3.18 ± 2.02 0-6	8.52 ± 0.99 7-10	167.9%	Paired t 16.4	<0.0001*

SDa: Standard deviation.

Table 4. Efficacy of dietary counseling on Anthropometric Measurements and Biochemical blood parameters.

PARAMETERS	BEFORE	AFTER	TEST OF SIGNIFICANCE	P VALUE
ANTHROPOMETRIC MEASUREMENTS				
WEIGHT (KG)	90.68± 12.05	83.06 ±11.97	Paired t= 11.68	<0.0001*
BMI (KG/CM^2)	34.24 ± 3.14	31.24 ± 3.17	Paired t= 12.18	<0.0001*
WAIST CIRCUMFERENCE (CM)	113.02 ± 11.37	103.46 ±8.26	Paired t= 11.33	<0.0001*
LIVER FUNCTION TESTS				
ALT (U/L) MEAN ± SD MEDIAN (IQR)	36.2 ± 34.66 23 (16 – 32)	20.74± 13.35 16 (11 – 32)	Wilcoxon signed-rank test	<0.0001*
AST (U/L) MEAN ± SD MEDIAN (IQR)	33.84 ± 20.76 25 (22 – 35)	21.29 ± 5.54 20 (18 – 22)	Wilcoxon signed-rank test	<0.0001*
ALBUMIN (G/DL) MEAN ± SD MEDIAN (IQR)	4.62 ± 0.39 4.5 (4.45 – 4.7)	4.73 ± 0.44 5.7 (4.5 – 4.9)	Wilcoxon signed-rank test	0.002*
GGT (U/L) MEAN ± SD MEDIAN (IQR)	35.77± 21.54 30 (25 – 40)	25.01 ± 10.44 21 (18 – 36)	Wilcoxon signed-rank test	<0.0001*
LIPID PROFILE				
CHOLESTEROL (MG/DL)	229.62 ± 35.5	185.07 ± 34.83	Paired t 12.62	<0.0001*
PLASMA TRIGLYCERIDES (MG/DL)	151.82 ± 61.92	113.51± 37.19	Paired t 8.16	<0.0001*
PLASMA LDL (MG/DL)	158.69 ± 29.19	115.21± 27.05	Paired t 14.08	<0.0001*
PLASMA HDL (MG/DL)	40.46± 13.39	46.89 ± 8.19	Paired t 4.18	<0.0001*
SUGAR CONTROL INDICATOR				
HA1C (%)	6.45 ± 1.09	5.91 ± 0.71	Paired t 6.32	<0.0001*

Table 5. prediction of fatty liver index improvement in relation to different factors.

VARIABLES	B[A]	SE[B]	T	BETA	P VALUE	ADJUSTED R SQUARE
AGE	-1.314	.100	-13.194	-.899	<0.0001*	0.883
PERCEIVED SEVERITY (MEAN DIFFERENCE)	2.287	.606	3.776	.234	<0.0001*	
SELF-EFFICACY (MEAN DIFFERENCE)	.996	.261	3.824	.317	<0.0001*	
HTN	-5.424	2.253	-2.407	.158	0.02*	
DM	-37.136	3.084	-12.044	1.405	<0.0001*	
BMI (BASELINE)	-2.014	.281	-7.174	-.475	<0.0001*	
PLASMA LDL (BASELINE)	-0.388	.033	-11.914	-.850	<0.0001*	
HA1C (BASELINE)	-15.288	1.142	-13.388	-1.258	<0.0001*	

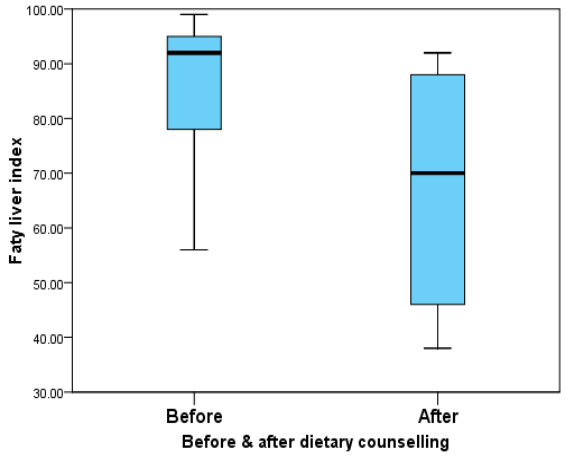

Figure 1. Efficacy of dietary counseling on fatty liver index.

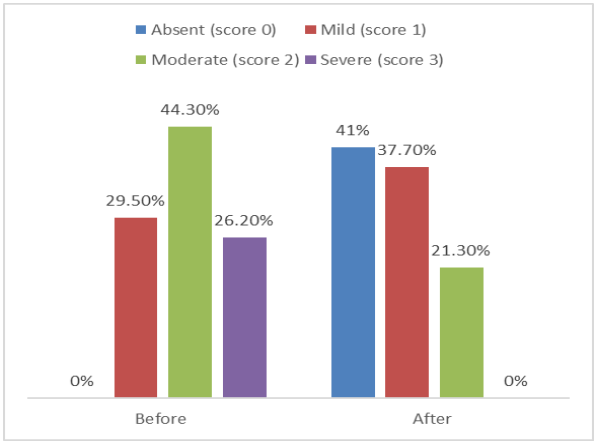

Figure 2. Efficacy of dietary counseling on ultra-sonography.

4. Discussion

According to the data available, the prevalence of MAFLD among Egyptians is approximately 32%, whereas the global prevalence is 25% so, it is considered a public health problem .[16] Since changing their lifestyle is proven to be the most beneficial treatment for MAFLD [17], it was necessary to find a way to help patients change their lifestyles.

Owing to the widespread failure of people to maintain lifestyle change, we decided to use an education model to improve compliance. HBM was chosen because it centers on how people view health risks and make decisions about how to proceed depending on how much importance they place on a specific objective and how likely it is that actions performed in that direction would result in the achievement of that objective. Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action are the six main cognitive constructs, or "dimensions," that impact behavior .[18,19]

The HBM has been used in various contexts, including lifestyle change in the Egyptian population. One study in diabetic patients found that when compared to pre-intervention, post-educational intervention based on HBM improved the patients' overall knowledge and self-care habits score in highly statistically significant ways.[20] Another study on hypertensive patients revealed a highly significant improvement in patients' knowledge, attitude, and blood pressure post-health belief model application.[21] An additional study on Medical Students about nicotine dependence showed that the proportion of students in the intervention group with high knowledge and belief levels had considerably increased following the intervention. Also, at 30 days after the intervention, students' mean nicotine dependence scores and the proportion of daily and heavy smokers decreased more in the intervention group than in the control group .[22]

Although practically proven the significant effect of HBM-based dietary counseling on lifestyle change and the improvement of the clinical disease, as far as we are aware, no research has been done on the efficacy of HBM in patients with MAFLD in Egypt.

Our study found that knowledge score and constructs of the Health Belief Model have improved significantly after intervention, which is consistent with other studies using the same model in different study groups such as adolescents, overweight secondary school female students, and type 2 diabetic patients .[20, 23, 24] The results are similar to those found in studies that have utilized other models, such as the transtheoretical model and protection motivation theory regarding scores of health beliefs .[25, 26]

In our study, we found highly significant reductions in weight, BMI, and waist circumference, which is in contrast to other studies that did not use a health education model where there are reductions but less significant [27, 28], and this in turn highlights the importance of the Health Belief Model.

Regarding biochemical parameters, the Liver enzymes (AST, ALT, Albumin, and GGT) are significantly lowered, which is in agreement with other studies .[29, 30] The lipid profile parameters significantly lowered, except for HDL, which significantly rose. These results were close to those of Li, Hou et al.[25] Unlike the results of Arab, Hadi et al. 2019 the reduction in the lipid profile was modest since it was accomplished in a very short time period by a very straightforward and cost-effective intervention .[27]

Regarding steatosis improvement, there is a highly significant improvement in the fatty liver index and ultrasonographic findings, contrary to previous studies, mostly due to using shorter periods of intervention .[29, 30]

Regarding using HBM constructs as predictors for clinical disease improvement, in our study, we found that Perceived severity and Perceived Self-efficacy were significant predictors for FLI improvement. In contrast to Hu, Liu et al. found that perceived severity, Perceived benefits, and perceived barriers were significant predictors of self-care behaviors in patients with type 2 diabetes .[31] As for Keshani, Hossein Kaveh et al. found that perceived susceptibility, Cues to action, and Perceived Self-efficacy were significant predictors for improving diet quality among adolescents .[23] These differences are most likely due to the model's application to a different population with a different health status.

This study has some limitations. It was a modest sample size. Only four months of follow-up were conducted; more time would be required to ensure long-term commitment to the lifestyle modifications. Despite using ultrasound and FLI, it was necessary to use Fibro Scan or liver biopsy (histopathology) results as an indicator for steatosis improvement.

4. Conclusion

In conclusion, the application of dietary counseling based on the health belief model can greatly enhance their health beliefs and knowledge, resulting in improvements in blood lipids and liver enzymes as well as a reduction in BMI and waist circumference. These health improvements are likely to prevent or even reverse MAFLD progression.

Disclosure

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Authorship

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There are no conflicts of interest.

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