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Nutritional Lifestyle Modification Program for Patients with Multiple Sclerosis

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Abstract

Background: Nutrition plays a role in alleviating symptoms of multiple sclerosis such as chronic, autoimmune inflammation of the central nervous system. **Aim:** was to assess the impact of a nutritional lifestyle modification program on patients with multiple sclerosis. **Design and setting:** A quasi experimental research conducted at Benha University Hospital at Cardiac Outpatient Clinic and multiple sclerosis Out-patient Clinic affiliated to Health Insurance Hospital. **Sample:** A convenience sample of 73 patients attended to previously mentioned settings. **Tools:** Two tools were used: **I)** A structured interviewing questionnaire to assess socio demographic characteristics of the studied patients, medical history and their knowledge. **II)** Nutritional lifestyle practices. **Results:** 76.3% and 71.7% of the studied patients had good total knowledge level about multiple sclerosis during post program and follow up phase respectively compared with 6.4% in pre-program phase. In addition; 82.1% and 81.5% of the studied patients had healthy total nutritional practices after implementation of the program and at follow-up phase respectively compared with 12.7% pre-program phase **Conclusion:** Nutritional lifestyle modification program succeeded in improving knowledge and nutritional lifestyle practices of the studied patients with multiple sclerosis. **Recommendations:** A simplified, comprehensive and illustrated Arabic language guide image booklet about nutritional lifestyle modification programs should be distributed for each newly admitted patient diagnosed with multiple sclerosis.

Key words: Nutrition, lifestyle modification, multiple sclerosis.

Introduction

Multiple Sclerosis (MS) is an immune-mediated inflammatory disorder that targets myelinated axons in the Central Nervous System (CNS), leading to the destruction of the myelin sheath and, to varying extents, the axon itself. The immune system attack these affected areas resulting in inflammation and the formation of scar tissue (sclerosis). The transmission of nerve impulses through these damaged fibers is impaired, leading to a range of neurological symptoms. While the exact cause remains unknown, it is believed to result from a combination of genetic predisposition and an external trigger—such as a viral infection or low vitamin D levels—that initiates a persistent autoimmune response, causing repeated immune assaults on the CNS **(22).**

Worldwide, over 2.8 million people have MS. Every day, about 300 people receive a diagnosis of multiple sclerosis worldwide. **(21).**

Individuals with MS experience a wide range of symptoms that vary significantly in severity from person to person. While weakness and numbness are common symptoms of this disorder, severe cases can lead to vision loss and paralysis **(6).**

Multiple sclerosis has four subtypes: The first and most common form, Relapsing-Remitting MS (RRMS), accounts for 80–85% of cases with episodes of symptom exacerbation followed by remission periods ; The second type, secondary progressive MS, emerges in 50% of patients previously diagnosed with RRMS within a decade; The third type, primary progressive MS, occurs in 10–15% of individuals with MS; and The fourth type, progressive-relapsing MS, affects only 5% of individuals with MS **(14).**

There is no cure for the disease, so treatment focuses on speeding up recovery from attacks and slowing its progression. The prognosis of this condition remains unpredictable, with patients facing a range of physical and mental challenges that significantly impact their daily activities, social and family life, functional independence, and future planning. It destroys the feeling of being good in a person and it is essential to recognize these issues, address concerns, and implement effective strategies to manage challenges **(9).**

Multiple sclerosis is a primary cause of non-traumatic disability among young adults. MS imposes a substantial economic burden, alongside considerable healthcare costs. It significantly impacts various aspects of daily life, including physical, psychological, social, and financial well-being, affecting both individuals and their families. The disease can hinder a person's ability to actively participate in family and community life, often leading to diminished self-worth and confidence. Adopting a modified lifestyle is one approach to achieving a better quality of life **(3, 24).**

In primary care settings, Community Health Nurses (CHNs) play a key role in identifying motor, sensory, and cognitive deficits that may aid in diagnosing MS, while patients are typically referred to a neurologist for further evaluation. CHNs are well-positioned to assist in recognizing and managing relapses, symptoms, and treatment-related side effects, all of which can influence the progression of the disease (**1).**

Significance of the Study

Dietary modifications are considered complementary treatment for controlling MS. Diet rich in fat, sugar, and animal protein may promote the growth of certain pathogenic bacteria, such as bacteroidetes, in the gut, potentially triggering enteric inflammation, compromising the intestinal barrier, and increasing cross-reactive adaptive immune cells. A diet abundant in vegetables and high in fiber, supplemented with probiotics, vitamin D, vitamin A, and lipoic acid, promotes gut eubiosis. This results in enhanced microbial diversity and an increase in microbe-associated anti-inflammatory mediators like Short-Chain Fatty Acids (SCFAs) **(26).**

In Egypt, statistics from the Ministry of Health and Population reveal that MS accounts for 1.4% of all neurological diseases. The most recent edition of the Atlas of MS, published in 2020, reported that approximately 59,670 individuals are living with MS in the country **(10).**

This study aimed to assess the impact of a nutritional lifestyle modification program on patients with MS via:

1. Assessing knowledge of patients about multiple sclerosis.
2. Assessing nutrition of studied patients with multiple sclerosis.
3. Designing and implementing nutritional lifestyle modification program for patients with MS .
4. Evaluating the effect of nutritional lifestyle modification program for patients with MS .

Research hypothesis

Nutritional lifestyle modification program will improve knowledge and nutritional lifestyle practices of studied patients with multiple sclerosis.

Subjects and methods

Design:

A quasi-experimental research design (pre-posttest and follow up).

Settings:

Benha University Hospital, at Cardiac Outpatient Clinic and MS Out-patient Clinic affiliated to Health Insurance Hospital, Benha, Qaluibia, Egypt

Sampling:

A convenience sample of 173 patients with MS were selected from the previously mentioned settings according to:

Exclusion criteria: Other chronic disease or mental disease.

Two tools were used for data collection.

Tool I: - The researchers designed a structured interview questionnaire comprising two sections.

The first: Focused on

A- Socio demographic traits of the patients participating in the research. It included 7 questions age, sex, education level, monthly income, living with, smoking and how long have been smoking.

The second: a- Medical history with MS, included 8 questions onset of the disease, the diagnosis of the disease, at any stage of the disease you are, reasons of the disease, number of relapse attack, follow up visits, treatment methods and family history of the disease.

b- Physical signs and symptoms of MS which included 13 questions.

The third: Focused on knowledge about MS. Consisted with 12 closed ended questions (multiple choice type) meaning of MS, causes, risk factors, common symptoms, less common symptoms, types, factors leading to MS relapse, diagnosis, prevention, treatment, side effects of treatment and complications..

Knowledge scoring system: The scoring system was as follows: (2) points for a correct and complete answer, (1) point for a correct but incomplete response, and (0) points for 'don't know.' Each knowledge item's scores were summed, and the total was divided by the number of questions, then converted into a percentage.

Total scores of knowledge= 24 points.

- **Good knowledge was** ≥75% (≥ 18 points.
- **Average knowledge was** 50% to less than 75% (12 < 18 points).
- **Poor knowledge was** less than 50% (< 12 points).

Tool II: Nutritional lifestyle practices: derived from **(2)** and composed of 10 questions about consume a variety of fruits rich in vitamins, minerals, and dietary fiber, such as pomegranate and guava. Include vegetables high in fiber and essential nutrients, like cauliflower, cabbage, and turnips. Opt for a diet abundant in healthy omega-3 fats found in salmon, herring, tuna, and mackerel. Limit red meat intake, especially processed options like pastrami and luncheon meat. Avoid foods high in sugar, alcohol, and caffeine, as well as those containing saturated fats, such as butter and fried foods. Steer clear of processed and fast foods that contain artificial dyes and preservatives. Prioritize eating breakfast, minimize exposure to passive smoking, and maintain adequate hydration by drinking two liters of water daily.

Scoring system:

calculated as follows a 3 points Likert scale with 3 possible responses: always has two score and sometimes has one score, while never has zero score.

Total score for nutritional lifestyle practices= 20

The total score of nutritional Lifestyle Practices was considered healthy when total practices score was ≥ 60 % (≥12 points), while considered unhealthy if it was < 60 % (<12 points).

Reliability and content validity of tool

Reliability:

Conducted using Cronbach's Alpha coefficient test, which demonstrated that both tools comprised relatively uniform items, as reflected by their moderate to high reliability. The internal consistency of knowledge was 0.76, while nutritional lifestyle practices were 0.81.

Content validity:

The tools were evaluated by five experts from the Community Health Nursing Specialties Department at Benha University, who provided feedback on their clarity, relevance, comprehensiveness, appropriateness, readability, and applicability.

Ethical considerations:

Permission to carry out the study was secured from the Scientific Research Ethics Committee, Faculty of Nursing, Benha University (REC-CHN-P85. Formal consent for participation was obtained before the interview, along with a brief explanation of the study purpose. Participants were also reassured that all information gathered would be confidential and used only for the purpose of the study. No names were required on the forms to ensure anonymity and confidentiality.

Approval

Before starting, A formal written consent from the Faculty of Nursing Dean Benha University, was delivered to the setting of study. The letter sought their approval for conducting the study after providing an explanation of its purpose. During data collection, verbal consent was obtained from each participant after a clear explanation of research's purpose to secure their cooperation.

Pilot Study:

Prior to data collection, it was carried out on 10 % (17 patients) of the total sample (173) to assess the clarity, feasibility, and applicability of the tools. Based on the data analysis results, no corrections or modifications were required, and the sample was included in the overall study.

Nutritional Lifestyle modification program include four phases:

(I) Preparatory and assessment phase:

Using the pre-test data gathered from the questionnaire and insights from the literature review, the researchers developed the program, which was then implemented immediately following the pre-test. Also, by collecting and analyzing baseline data from the completed tools, the researchers evaluated knowledge and nutritional lifestyle practices related to MS .

(II) Planning stage: researchers determined key needs of the target group, prioritized these needs, and developed the corresponding goals and objectives.

The program objectives:-

Patients' knowledge and health lifestyle practices toward MS will be improved, at the end of this program. **Specific objectives:** Patients will be able to at the end of this program:

- Recognize all objectives of the nutritional lifestyle modification program and outcomes.
- Identify meaning of multiple sclerosis.
- Mention causes of multiple sclerosis.
- List risk factors of multiple sclerosis.
- Mention types of multiple sclerosis.
- Enumerate signs and symptoms of multiple sclerosis.
- Recognize diagnosis of the disease
- Identify complications of multiple sclerosis.
- Identify methods of treatment of multiple sclerosis.
- Identify side effects of treatment of multiple sclerosis
- Explain methods of preventing of multiple sclerosis.
- Identify importance of follow up for disease
- Identify importance of follow up for disease.
- Construct healthy diet.

III) Implementation of the program:

Collection of data over a period of 6 months from the beginning of September 2023 to the end of February 2024. The study was conducted at Benha University Hospital, there is no clinic dedicated to patients with MS, so the Cardiac Outpatient Clinic was scheduled for these patients on Sunday every week. The researchers visited Benha University Hospital on Sundays per week during morning shifts from 9 am- 1 pm. During a session a group of 4 or 5 patients were attended.

Also, the researchers visited Health Insurance Hospital Outpatient Clinics, two days/week (Second and fourth Tuesdays every month according to Health Insurance Hospital's system) from 9 am- 1 pm. During a session a group of 4 or 5 patients were attended.

After three months the researcher conducts follow up questionnaire from the beginning of June 2024 to the end of August 2024 as following: The researcher went to the studied sample at their homes three days/ week (Saturdays, Mondays and Tuesdays). researchers collected from 4 to 5 questionnaires every day.

Oral approval was received after the researchers introduced themselves to the patients and explained the purpose of the study. The researchers implemented the program through 6 sessions; 3 theoretical and 3 practical.

Each session begins with a recap of the previous session's content and the objectives of the new topics, and concludes with a summary of the key points discussed. Motivation, open discussion and reinforcement were used during the lecture to enhance learning. At the end of each session, an open discussion was held to clarify any misunderstandings, and patients were informed about the timing of the next session.

First session: At the start of the first session, the researchers welcomed and introduced themselves to the patients, provided an overview of the program and its process, clarified both the general and specific objectives, and outlined the expected outcomes. Information on the definition, causes, and types of MS was shared using clear and simple language.

Second session: Included information on the signs and symptoms of MS, as well as its risk factors and complications.

Third session: Covered methods of treatment, side effects of treatment of MS, methods of preventing of MS and importance of follow up.

Fourth session: Covered the construction of healthy diet

Fifth session: Covered the importance of compliance with prescribed treatment.

Six session: Discussed and revised about all sessions include any questions from patients.

Teaching methods: All participants were provided with the same educational content using identical teaching methods, including lectures, group discussions, and demonstrations/redemonstrations. **Teaching media:** Booklets, colored posters, videos was used. **Methods of evaluation:** Feedback (verbal and non-verbal) and re-demonstration.

(IV): The program's effectiveness was assessed using a post-test, identical to the pre-test questionnaire, to compare changes in patients' knowledge and practices immediately after the implementation of the nutritional lifestyle modification program. A follow-up phase was conducted three months later.

Statistical analysis:

The collected data were analyzed, organized, and presented in figures using number and percentage distributions, as well as mean and standard deviation, with the aid of the Statistical Package for the Social Sciences (SPSS) version 21. Appropriate statistical tests were applied, including number and percentage, mean, standard deviation (SD), Chi-square (X^2), and Pearson correlation coefficient (r) for qualitative data. The P-value was used to assess the significance of the results as follows:

$P > 0.05$ Not significant

$P < 0.05$* Statistically significant $P < 0.001$** Highly statistically significant.

Results:

Table (1): 37% of studied patients aged from 40 to less than50 years with a mean age of 36.06±9.25 and 72.8% of them were females. Also; 46.2% of patients had secondary education and 68.8% of them had insufficient income.

Table (2): 48% of the patients had multiple sclerosis from 5 to less than10 years, 79.8% of them had relapsing remitting multiple sclerosis and 86.1% of them had less than 5 times relapse attack in the previous two years. In addition; 75.1% of patients were following up every 6 months and 96.5% of them were treated with oral therapies.

Table (3): 89. 6% of studied patients had numbness in face and body, and 84.4% of them had extreme fatigue and exhaustion.

Figure (1): Illustrates that; good total knowledge level occurred only 6.4% of patients regarding multiple sclerosis at pre-program implementation, while increased to 76.3% and 71.7% post-program implementation and at follow-up phase respectively.

Figure (2): Prior to the program, only 12.7% of the patients had healthy overall nutritional lifestyle practices. However, this percentage rose to 82.1% after the program implementation and remained at 81.5% during the follow-up phase.

Table (4): Before the program, a strong positive correlation was found between total knowledge score and education, while negative correlations were observed between the total knowledge score and socio- demographic factors such as sex and income, with age showing a positive correlation. After the program implementation positive correlations were found between total knowledge score and age and income, while education had a strong positive correlation, and a negative correlation was seen between the total knowledge score and sex. During the follow-up phase, significant positive correlations were found between total knowledge score and socio-demographic characteristics such as age, sex, and education. However, a negative correlation was observed with income

Table (5): Before the program, a positive correlation was observed between total nutritional practices score and demographic factors such as age, education, and income, while a negative correlation was found with sex. After the program was implemented, there was a strong positive correlation between total nutritional practices score and age,

education, and income, and a positive correlation was noted between the total practices score and sex. At the follow-up phase, positive correlations were found between total practices score and age, sex, education, and income.

Table (6): There was a significant positive correlation between total knowledge and total nutritional lifestyle modification practices before the program implementation. After the program was implemented and at the follow-up phase, a highly statistically significant positive correlation was observed between total knowledge and total nutritional lifestyle modification practices among the studied patients.

Table (1) Socio-demographic characteristics of studied patients (n=173).

Socio demographic characteristics		No	%
Age/years	<20	12	6.9
	20<30	36	20.8
	30<40	52	30.1
	40<50	64	37.0
	≥50	9	5.2
	Min -Max	17-53	
	Mean ±SD	36.06±9.25	
Sex	Male	47	27.2
	Female	126	72.8
Education	Can't read or write	9	5.2
	Primary education	7	4.0
	Secondary education	80	46.2
	University education and more	77	44.5
Income	Enough and saving	24	13.9
	Enough	30	17.3
	Not enough	119	68.8

Table (2) Medical history of the studied patients (n=173).

Medical history	No	%
The onset of the disease/ years		
<5	53	30.6
5<10	83	48.0
≥10	37	21.4
The stage of the disease:		
Relapsing-remitting multiple sclerosis	138	79.8
Secondary progressive multiple sclerosis	9	5.2
Primary progressive multiple sclerosis	9	5.2
Don't know	17	9.8
Number of relapse attack in the previous two years:		
<5 times	149	86.1
5-10 times	24	13.9
Follow up visits:		
Every 3 months	28	16.2
Every 6 months	130	75.1
When necessary	15	8.7
***Treatment methods:**		
Injectable medications	81	46.8
Oral therapies	167	96.5
Intravenous therapy	88	50.9
Corticosteroids	41	23.7
Plasma change	4	2.3
Physical therapy	53	30.6

***Answers are not mutually exclusive**

Table (3) Signs and symptoms with multiple sclerosis of the studied patients (n=173).

Items	No	%
Extreme fatigue and exhaustion	146	84.4
Difficulty walking (imbalance – dizziness)	117	75.1
Numbness in the face and body	107	89.6
Pain in the body	95	75.7
Muscle weakness and stiffness	83	66.5
Vision problems	28	61.3
Difficulty thinking and memory problems	14	50.9
Bladder and stomach problems	35	60.7
Sexual problems	14	8.1
Difficulty speaking and swallowing	25	14.5
Breathing problems	16	9.2
Headache	38	56.6
Shivering and itching in the body	35	20.2

***Answers are not mutually exclusive**

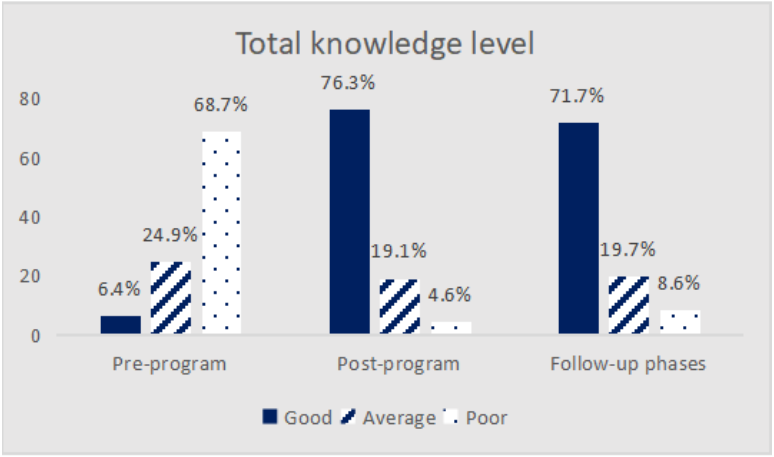

Fig. (1) Distribution of the studied patients regarding their total knowledge level through the program phases (n =173).

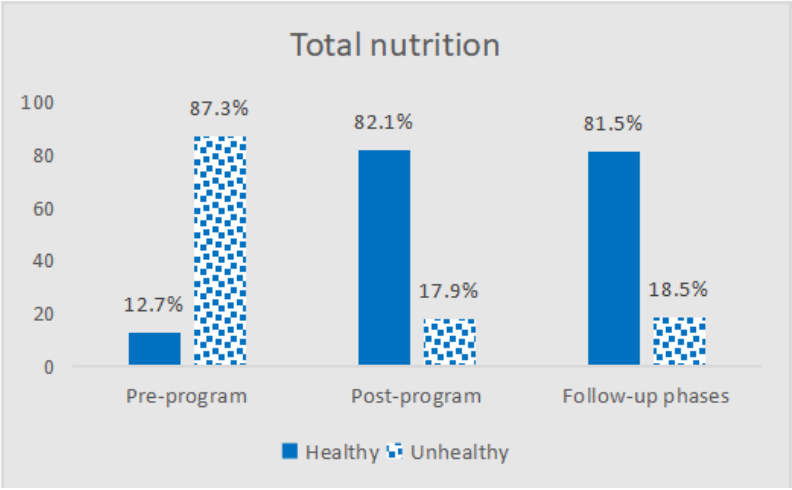

Fig. (2) Total nutrition practices through the program phases of studied patients (n=173)

Table (4) Correlation between total knowledge score and socio-demographic characteristics through the program phases of studied patients.

Socio demographic characteristics	Total knowledge					
	Pre		Post		Follow-up	
	r	P value	r	P value	r	P value
Age	.191	.012*	.684	.031*	.723	.027*
Sex	.077	.316	.192	.100	.718	.028*
Education	.270	.029	.492	.000**	.709	.000**
Income	.066	.387	.978	.002*	.125	.102

****A Highly significant p ≤ 0.001 *significant P≤0.05**

Table (5) Correlation between total nutritional practices score and socio-demographic characteristics through the program phases of studied patients**.**

Socio demographic characteristics	total nutritional practices					
	Pre		Post		Follow-up	
	r	P value	r	P value	r	P value
Age	.184	.015*	.776	.000**	.729	.009*
Sex	.130	.089	.808	.019*	.876	.012*
Education	.234	.002*	.873	.000**	.855	.042*
Income	.202	.008*	.650	.000**	.515	.003*

****A Highly significant p ≤ 0.001 *significant P≤0.05**

Table (6) Correlation between total knowledge and total nutritional lifestyle modification practices through the program phases among studied patients.

Total nutritional lifestyle modification practices	Total knowledge					
	Pre		Post		Follow up	
	r	P value	r	P value	r	P value
	.176	.22	.722	.000**	.614	.000**

****A Highly significant p ≤ 0.001 *significant P≤0.05**

Discussion

Regarding medical history, the present study showed that less than half of the studied patients had been diagnosed with MS for a duration of 5 to less than 10 years. This result was consistent with **(8),** who studied "The relationship between self-care ability and health-promoting behaviors of patients with multiple sclerosis in Khuzestan" (n=112), and reported that the history of the disease is less than 10 years. While, this finding was inconsistent with **(18),** who studied "Effect of acupressure pain and fatigue among patients with multiple sclerosis in Egypt" (n=60), and found that more than half (53.3 %) of both control and study groups had MS for less than five years. This might be due to the late diagnosis of the disease.

Regarding stage of the disease, we revealed that over three-quarters of the patients in the study were in the relapsing-remitting stage of multiple sclerosis. This was align with **(19),** who revealed that majority (81.7 %) of patients had relapsing remitting multiple sclerosis.

Also, this study revealed that most of the patients in the study experienced less than five relapse attacks in the past two years. This result was consistent with **(16),** showed that two thirds (66.7%) of the participants had experienced 0 to 5 attacks.

Regarding follow-up visits, the current study revealed that three-quarters of the patients were attending follow-up appointments every 6 months. This result was align with **(27),** who studied "Exploring the experience of multiple sclerosis patients in Turkey: Insights from a national survey" (n=2176), and stated that three fifths (60.4%) of patients were performed follow up phase every 3 to 6 months. This might be due to patients dispense treatment every 6 months.

Most patients were treated with oral therapies. This results agreed with **(11),** who studied "Disability status among multiple sclerosis patients in relation to clinical features and switched drugs in Egypt" (n=274), and found that the most common drug is Fingolimod, which is a type of oral therapy in three fifths (60.9%) of patients. Also, with **(28),** who

studied "Evaluation of the relationship between socio-demographic characteristics and social support with adherence to treatment in Patient with multiple sclerosis in Turkey" (n=200), and found that less than three fifths (57.5%) of patients were using oral treatment.

Concerning physical disorders, the majority of patients had numbness in face and body. This result was in line with **(13),** who studied "Multidimensional assessment of tremors in patient with multiple sclerosis in Egypt" (n=150), and clarified more than half (53.33%) of participants had numbness in extremities. Also, with **(4),** who studied "Lesion load assessment among multiple sclerosis patient using DIR, FLAIR, and T2WI sequences in Saudi Arabia" (n=97), and stated the most frequent symptom was numbness. This might be due to damaged nerves in the spinal cord and brain that cause disruptions in pathways and result in abnormal sensation or no sensation.

This study found that the majority of patients felt extreme fatigue and exhaustion. This result was consistent with **(14),** who studied "Impact of fatigue and pain on activity of daily living among patients with multiple sclerosis in Egypt" (n=150), stated more than three quarters (78.7%) of study sample had significant fatigue.

Regarding the overall knowledge level of patients about multiple sclerosis, we found that more than two-thirds of the patients had poor knowledge before the program implementation. However, this percentage significantly decreased, with only a small minority showing poor knowledge after the program and at the follow-up phase. This agreed with **(25),** who studied "Self-management program to adapt with multiple sclerosis problems and enhance quality of life in Egypt" (n=90), and found that Approximately two-fifths (42.2%) of patients had poor knowledge before the program, but this improved significantly, with nearly two-thirds (63.3%) demonstrating good knowledge after the self-management program, showing a highly statistically significant difference.

About total nutritional practices, nearly less than one-fifth of the studied patients had healthy total nutritional practices before the program, but this percentage increased to the majority during the post-program and follow-up phases. This was in agreement with **(20),** studied "Nutritional intervention in patients with multiple sclerosis, correlation with quality of life and disability—A prospective and quasi-experimental study in Greece" (n=130) and found that the patients in the intervention group showed an improvement in their dietary habits.

About correlation between the total knowledge score and socio-demographic characteristics, the current study found a highly significant positive correlation between total knowledge score and their level of education in the pre-program phase. This agreed with **(15),** who studied "Quality of life needs for patient with multiple sclerosis in Egypt" (n=70), and found a highly significant relation between the total knowledge of the studied patients and their level of education. This could be attributed to the fact that the majority of the study sample had secondary education, which likely enabled them to better comprehend their disease compared to illiterate patients.

Furthermore, there was negative correlation between the total knowledge score of the studied patients and their sex during the pre-program phase. This disagreed with **(12),** who studied "Effects of self-care education program on quality of life of patients with multiple sclerosis in Egypt" (n=80), and showed that A significant difference was observed between genders, with females demonstrating a higher level of knowledge than males, and fewer than two-thirds of those with good knowledge being female.

A highly significant positive correlation was found between the studied patients' total knowledge score and their education after the program was implemented. This agreed with **(23),** stated that that A highly significant relationship was observed between the post-nursing intervention results and the educational level

Regarding the correlation between total nutritional practices and socio-demographic characteristics of patients throughout the program phases, there was a negative correlation between sex and total practices before program. This agreed with **(5),** who studied "The quality of life in patients with multiple sclerosis in Qassim in Saudi Arabia" (n=95), found that there was no significant mean difference between poor lifestyle and sex. This might be due to that MS affects both genders almost equally.

Also, there was a positive correlations between their socio-demographic characteristics and total nutritional practices score, such as education, during the pre-program phase. This was aligned with **(17),** who studied "self-care practices and related factors in patients with multiple sclerosis based on the health belief model in Iran" (n=280), found finally a direct association between educational levels and practices.

About the correlation between total knowledge and total nutritional practices, there was significant positive correlation between total knowledge and total nutritional practices during the

pre-program phase. After the program implementation and at the follow-up phase, there was a highly significant positive correlation between total knowledge and total nutritional lifestyle modification practices among patients. These findings disagreed with **(7),** who studied "Effect of health promotion program on therapeutic regimen compliance for patients with multiple sclerosis in Egypt" (n=60), and reported a significant positive correlation between total practice score, the overall total knowledge score, and total nutritional lifestyle habits after the program. This might be associated with a nutritional lifestyle modification sessions that improved the studied patient's knowledge scores and practices.

Conclusion:

From the results of the present study, it can be concluded that; nutritional lifestyle modification program succeeded in improving patients' knowledge and modifying nutrition practices toward MS. As evidence few of patients had good total knowledge level about multiple sclerosis at pre-implementation then increased to about three quarters post-program implementation and at follow-up. Also, less than one-fifth of patients had healthy overall nutritional practices during the pre-program phase, but this percentage increased during follow-up phases and post-program. Furthermore, a highly statistically significant positive correlation was found between the total knowledge score and total nutritional practices scores of patients.

Recommendations:

- A larger sample size in additional research– is necessary to assess the burden of MS and its effects on patients.
- Nutritional lifestyle modification program should be included in the routine nursing MS care and rehabilitation process for patients.
- A simplified, comprehensive and illustrated Arabic language guide image booklet about nutritional lifestyle modification programs should be distributed for each newly admitted patient diagnosed with MS.
- Establish web page channel to connect with MS patients for dealing with emergencies.

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