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The Efficacy of Motivational Interviewing on Glycemic Control for Patients with Diabetes

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Abstract: **Diabetes mellitus (DM) is increasingly becoming a major chronic disease affliction all over the world and its prevalence in Egypt has increased quickly within a relatively short period from nearby 4.4 million in 2007 to 7.5 million in 2013. It has no known cure and is a chief cause of morbidity and mortality. Motivational interviewing (MI) may help to empower patients with diabetes to make changes in their lifestyle leading to better control of their diabetes.**

The Main Objective; of this study was to evaluate the efficacy of motivational interviewing on glycaemic control for patients with diabetes.

The Research Hypothesis; motivational interviewing has a positive effect on glycemic control for patients with diabetes.

The Study Subjects consisted of 93 patients diagnosed with diabetes mellitus at the outpatient clinic at Ain Shams University Hospitals, Cairo, Egypt.

The tools of data collection were: 1) Patient's assessment and clinical data sheet, 2) Patient's knowledge assessment sheet, and 3) Diabetes readiness to change questionnaire.

The results exposed that there were statistically significant differences for patients under study in relation to the patient's level of knowledge, patient's readiness to change and glycemic control throughout motivational interviewing implementation.

In conclusion; improvement was obvious in the level of knowledge, patients' readiness to change, and reduction of blood sugar of patients under study after attending the motivational interviewing intervention.

Recommendation: nurses have an active role in eliciting behaviour change in high-risk lifestyle behaviours as diabetes mellitus.

Keywords: **Diabetes Mellitus, Motivational Interviewing, Glycemic Control.**

1. INTRODUCTION

Diabetes is one of the most common metabolic disarranges within the world and in later decades the predominance of diabetes among adults has expanded **(Shaw et al., 2010 and Whiting et al., 2011)**. It is a gathering of illness characterized by an increased level of blood glucose due to insulin secretion defects, insulin action or both (**American Diabetes Association, 2018)**.

Data provided recently indicate that around 150 million people worldwide have diabetes mellitus and that by 2025 this number can double. Much of the increase is caused in developing countries by population growth, ageing, malnutrition, overeating and unhealthy lifestyles. Diabetes mellitus (DM) is a major clinical and public health issue arising in Egypt (**World Health Organization, 2018)**.

Egypt has ranked among the top 10 nations in the world with diabetic patients by the International Diabetes Federation (IDF). **(Federation, 2013)**. The percentage of people with diabetes is expected to increase in the Middle East and North Africa(MENA) area by 96% from the year 2013 to 2035 or from 34.6 million to 67.9 million **(Whiting et al., 2011)**. Latest changes in physical and dietary activity have promoted diabetes growth, but by 2025, more than 9 million Egyptians (13 percent of the population over 20 years) will suffer from diabetes if various preventive and control measures are not taken. **(Abdo and Mohamed, 2010)**. 90% of all cases of diabetes in the world are diabetes of type 2 (**World Health Organization, 2018)**.

The long-term damage of different organs is connected with chronic diabetes hyperglycemia **(Maitra & Abbas, 2005)**. Chronic diabetes hyperglycemia is linked to long- term damage, dysfunction and failure of various organs, particularly the eyes, kidneys, nerves, heart and blood vessels. (**American Diabetes Association, 2018)**. In close cooperation with the patients and providers of health care, diabetes should be treated to avoid long- term complications and early death **(Al-Hazzaa et al., 2011)**.

Patients with diabetes can lead a full life while keeping their blood glucose under control. However, this disease requires a life-long management plan, and patients with this disease have a main role in this plan. Plan of diabetes management can be a very effective way to keep blood sugar under control. Nevertheless, they aren't ever easy but they can be very effective for controlling blood sugar. The absence of long-term complications can be enhanced and prevented **(Evans and Pinzur, 2005)**. Non- pharmacological management of DM depends on physical activities and diet. **(World Health Organization, 2018)**. Failure to comply with care plans and variances from good food and physical activity in patients with DM are responsible for poor results from healthy eating and physical activity **(Christie & Channon, 2014)**. Motivational interviews have been demonstrated to improve the lifestyle of weight management changes, including physical activity **(Hardcastle et al., 2012)**.

Motivational interviews have also received attention as a patient-centered approach to advice on behavioral change, usually when a patient feels ambivalent, e.g. about lifestyle choices or medication adherence **(Edwards, & Elwyn, 2009)**. A motivational interview approach allows clinicians to advise while recognizing and exploring variations in the commitment and interest of individuals in changing their behavior. **(Rollnick et al., 2010)**.

Motivational interviews focus on helping patients identify and resolve ambivalence about changing their behavior, usually by exploring their personal views and perceived barriers. **(Rollnick et al., 2008)**. It has also been used to treat patients who need to change their lifestyles. This technique was taught and implemented in a different care environments. Research shows that the implementation of motivational interviewing (MI) for diabetes patients can be an effective approach to addressing the problems arising from the treatment of this population **(Clifford Mulimba & Byron-Daniel, 2013)**.

The significance of the Study:

Diabetes Mellitus is a global escalating public health problem because of the increasing prevalence, is estimated to affect 285 million individuals worldwide **(Shaw et al., 2010)** and is now reaching to the epidemic in some countries **(Atlas, 2011)**. Egypt had been estimated to be the 9th country in the prevalence of diabetes **(Abdo and Mohamed, 2010)**. It is a serious disease that can often be managed by physical activity, diet and the proper use of insulin and other drugs to control blood sugar levels. **(Centers for disease control and prevention, 2017)**.

Patients play a chief role in diabetes care because of their daily responsibility for a large number of behavioural choices and activities **(Heinrich et al., 2010)**. Assisting patients in enhancing their diabetic-management needs consideration of their self-efficacy and motivation (**Wallace et al., 2009; Al-Khawaldeha et al., 2012)**. There is a chance to work with DM patients to help reduce the disease process and improve overall health. MI is an effective tool to help nurses understand and change their perceptions better **(Ostlund et al., 2015).** MI is instrumental in assisting patients with type 2 diabetes to make lifestyle changes during the first six months after the approach has been implemented **(Song et al., 2014).**

The aim of the study:

The aim of the study was to evaluate the efficacy of motivational interviewing (MI) on glycemic control for patients with diabetes.

Research Hypotheses:

Motivational interviewing will affect positively on glycemic control for patients with diabetes.

2. SUBJECT AND METHODS

Research Design: The quasi-experimental design was applied to achieve the aim of the current study.

Setting: The study was conducted at the Outpatient Clinic at Ain Shams University Hospitals, Cairo, Egypt.

Sample: A purposive sample of 93 patients was recruited after their acceptance to share in the study. **Inclusion Criteria** included that the patients should be adult and had a clinical diagnosis of type 2 diabetes. Patients were excluded from the study if they were subject to a care order or receiving other intervention from social services, if they had learning disabilities, or were undergoing psychiatric treatment. The sample size was estimated with STATA 10 program. The estimated required sample size was 103 patients, to achieve power of study 80%, power = 0-8000 and alpha=0.0500. Fifteen patients dropped out due to losing at the follow-up time.

Tools for data collection:

1- Patient's assessment and clinical data sheet: it contains two parts:

Part 1: It was intended to collect data about socio-demographic characteristics of the patients under study to provide descriptive data regarding the patient's age, sex, marital status, educational level, and work status.

Part 2: The sheet was designed by the researchers to gather information related to the duration of illness, blood sugar, treatment, body mass index (BMI) and family history of diabetes.

Scoring system:

BMI was estimated by dividing weight in kilogram by squared height in meters [BMI = weight (kg)/height (m)$^{2]}$. A BMI of less than (18.5) was underweight, a BMI from (18.50 - 24.99) considered normal while a BMI from (25 – 29.9) considered overweight and ≥ 30 was considered obese **(World Obesity Federation, 2015).**

2- Level of Knowledge

This part was used to assess patient's level of knowledge pre/post -MI implementation in relation to diabetes, nutrition, exercise, glucose-check and treatment (**American Diabetes Association, 2018 and World Health Organization, 2018)**. The reliability test was done whereas Cronbach's Alpha equal 0.877

Scoring System:

The total score of the questionnaire was 40 marks. Each correct answer had one mark while the incorrect one had zero.

3- Diabetes Readiness to Change Questionnaire

It was developed by the researcher after reviewing the related literature in order to assess the patient's stage of readiness to change. It was based on the Transtheoretical Stages of Change Model. This model postulates that the cessation of high-risk behaviours such as smoking, and acquiring behaviours with a benefit to health such as exercise **(Prochaska, DiClemente, 1984)**. The reliability test was done whereas Cronbach's Alpha equal 0.892

Scoring System:

It was divided into ten aspects of diabetes lifestyle, including dietary regimen, glucose-check and follow up, exercise, smoking cessation, medication regimen, avoidance& management of complications, and psychological, spiritual, emotional, and social aspect. It scored as; Strongly Disagree =0, Disagree =1, Not Sure =2, Agree=3, Strongly Agree=4.

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Pilot Study:

The pilot study was conducted on 10 patients in order to assess the clarity, feasibility of the tools and determine the needed time to answer the questions. Based on its result, modifications and omissions of some details were done and then the final forms were developed. Sample who involved in the pilot study were excluded from the study sample.

Fieldwork

Before conducting the study, permission was obtained from administrative personnel of Ain Shams University Hospital and informed consent of the patients who were participating. The data collection period was for 12 months, starting from the beginning of October 2015 to the end of September 2016. The study has involved the progression through five stages of change model. These stages are often described as degrees of "readiness to change".

Pre-Contemplation Stage

During this stage, patients are giving no thought to change and do not even consider changing.

Contemplation Stage

Patients are considering making a change at some point in the future. In this stage, all patients were interviewed individually by the researcher in an outpatient clinic to gather health information such as lifestyle indicators. In order to participate in the study, patients with type 2 diabetes who met the criteria were approached. A patient consent form was obtained. Patients not participating in the study received the same routine quality care as the hospital described.

Preparation Stage

A researcher in this stage is planning on making a change soon. During this stage, the researcher emphasized the patient as a key element in controlling blood sugar.

Action Stage

In this stage, the patient is in the process of making changes. A researcher with their patients discussing healthy lifestyle to include healthy food choices, exercise, and medications, as well as their readiness to change. After the interview was completed, the researcher monitored blood sugar. The patient's blood sugar result was then shared with the researcher. After the results were provided to patients, written educational materials were offered. Researcher interactions with patients have lasted from 40-60 minutes.

Maintenance" Stage

Patients were asked to complete the questionnaire on diabetes readiness to change in order to evaluate changes in patient perceptions of their health and lifestyles. Blood sugar was monitored again to determine the efficacy of the motivational interviewing intervention. Patients in this stage were reassessed at 3 months and then 6 months to ensure the continuation of changed behaviour.

Ethical and Administrative Considerations

The official authorization was obtained from the authoritative person in the hospital. The researchers introduced themselves to the patients who contented the inclusion criteria and informed them about the purpose of the current study to obtain their approval to share in this study. Patients were informed that they were voluntary to participate in this study and could withdraw without giving reasons at any time. Each patient received written consent to take share in the study. Confidentiality and anonymity of them were assured through coding the data obtained from them.

Statistical Analysis

The statistical analysis was carried out using (SPSS) version 20 windows and was presented in tables and graphs. Data were analysed using appropriate statistical methods. i.e. percentage, arithmetic mean (X), standard deviation (SD), and Chi-square analysis. Regarding P value, it was considered that: non-significant (NS) if $P > 0.05$, Significant (S) if $P < 0.05$.

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3. RESULTS

Table (1): Number and percentage distribution of socio-demographic characteristics among patients under study, n= 93.

Items	No.	%
Age (years):		
< 40	35	37.7
≥ 40 < 50	27	29.0
≥ 50	31	33.3
Mean±SD	47.20±10.45	
Gender:		
Male	34	36.6
Female	59	63.4
Marital status:		
Married	74	79.6
Unmarried	19	20.4
Education:		
Illiterate	21	22.6
Read/write and Basic/intermediate	46	49.5
High	26	27.9
Work status:		
Work	54	58.1
Not Work	39	41.9

Table (1): illustrates the socio-demographic characteristics of the patient under study. According to the table, the mean age of the studied group was 47.20±10.45 years. Additionally, less than two-thirds of the patients under study were female (63.4%), and more than half of them are working (58.1%). More than three-quarters of the patients were married (79.6%) and more than one-fifth of them was illiterate (22.6%) compared with more than one quarter were highly educated (27.9%).

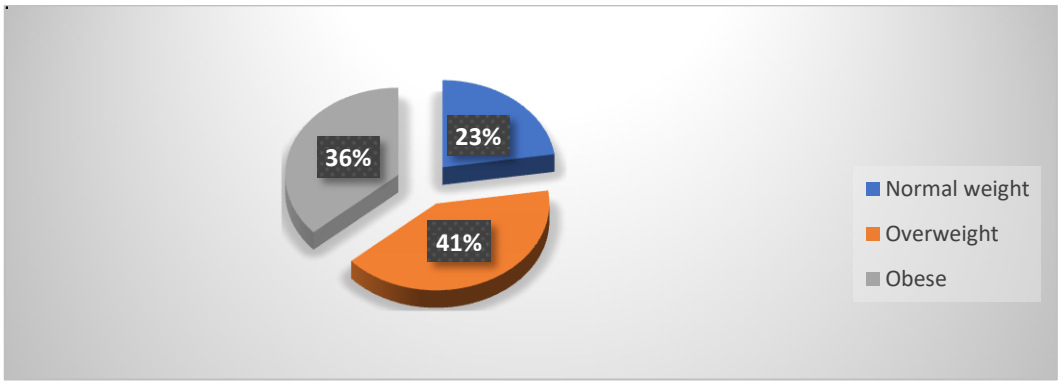

Fig. (1): Number and percentage distribution of body mass index among patients under study.

The above figure illustrates that less one-quarter of patients were a normal weight (23%) and more than two-fifths of them were overweight (41.0%).

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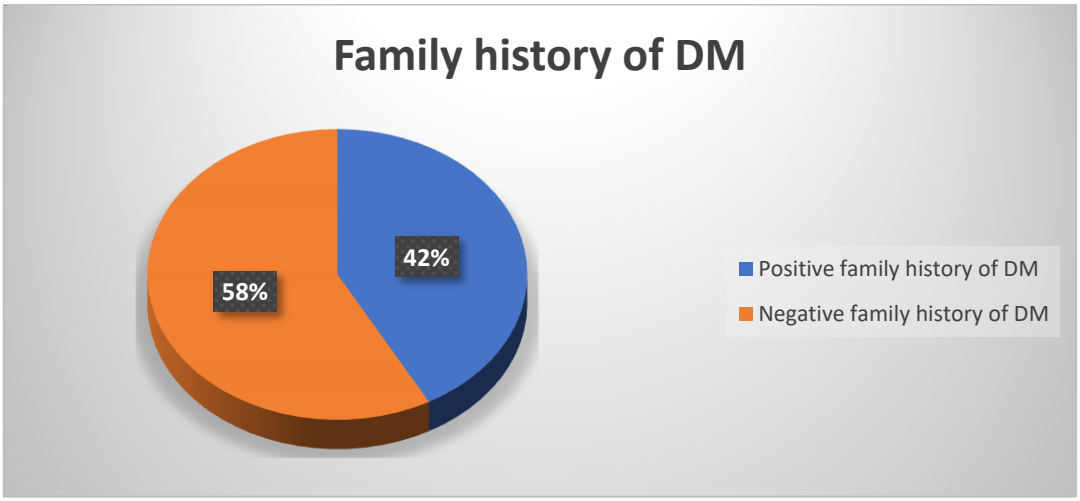

Fig. (2): Family history of diabetes mellitus among patients under study.

The results in figure (2) revealed that more than two-fifths of patients included in the study 42.0% had a positive family history of diabetes.

Table (2): Number and percentage distribution of disease duration, smoking status and treatment among patients under study, n= 93.

Items	No.	%
Duration of disease: (In Years):		
< 5	23	24.8
5 -	31	33.3
> 10	39	41.9
Treatment:		
Tablet	32	34.4
Insulin	39	41.9
Both	22	23.7
Smoker	29	31.2
Non-smoker	64	68.8
Passive smoking:		
Exposed	21	32.8
Not exposed	43	67.2

Table (2): shows that more than two-fifths of patients had DM from more than ten years (41.9%). The table also illustrated that more than one-fifth of patients under study were on tablet and insulin (23.7%). Regarding smoking status, more than two-thirds of patients were non-smokers (68.8%) and approximately one-third of them were exposed to passive smoking (32.8%).

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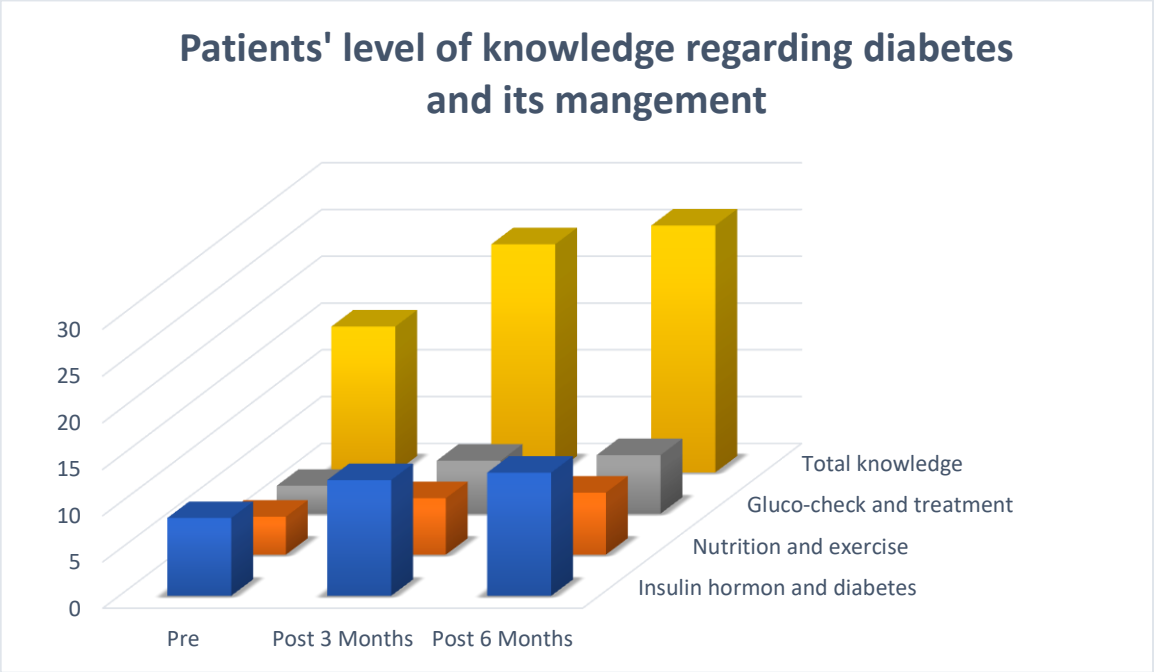

Fig. (3): Effect of the motivational interviewing intervention on knowledge for patients under study.

There were statistically significant differences among the study group regarding the level of knowledge post-MI intervention implementation (P<0.001).

Table (3): Patient's readiness to change pre and post motivational interviewing intervention implementation

Items	Studied group n = (93)			P value
	Pre	Post 3 Months	Post 6 Months	
Dietary regimen	38.1±8.64	42.3±8.37	43.7±7.02	*0.000
Gluco-check and follow up	17.4±3.33	21.0±4.36	21.8±3.82	*0.000
Exercise	9.86±2.83	13.1±3.44	14.4±2.72	*0.000
Smoking cessation	3.0±1.34	4.4±1.57	5.3±1.31	*0.000
Medication regimen	11.7±4.31	15.1±3.35	16.2±3.07	*0.000
Avoidance& management of complications	33.4±5.93	37.8±6.81	39.4±4.76	*0.000
Psychological aspect	12.9±2.76	16.6±3.66	17.7±2.89	*0.000
Spiritual aspect	14.4±3.15	17.1±1.95	17.9±1.72	*0.000
Emotional aspect	14.8±3.39	18.6±4.17	20.5±3.04	*0.000
Social aspect	12.3±2.0	14.2±1.27	14.9±0.54	*0.000
Total	168.0±21.49	200.6±23.92	212.3±19.05	*0.000

* Significant

The results in a table (3) shows a statistically significant difference regarding patient's readiness to change (dietary regimen, glucose-check and follow up, exercise, smoking cessation, medication regimen, avoidance& management of complications, and psychological, spiritual, emotional, and social aspect) (P<0.001).

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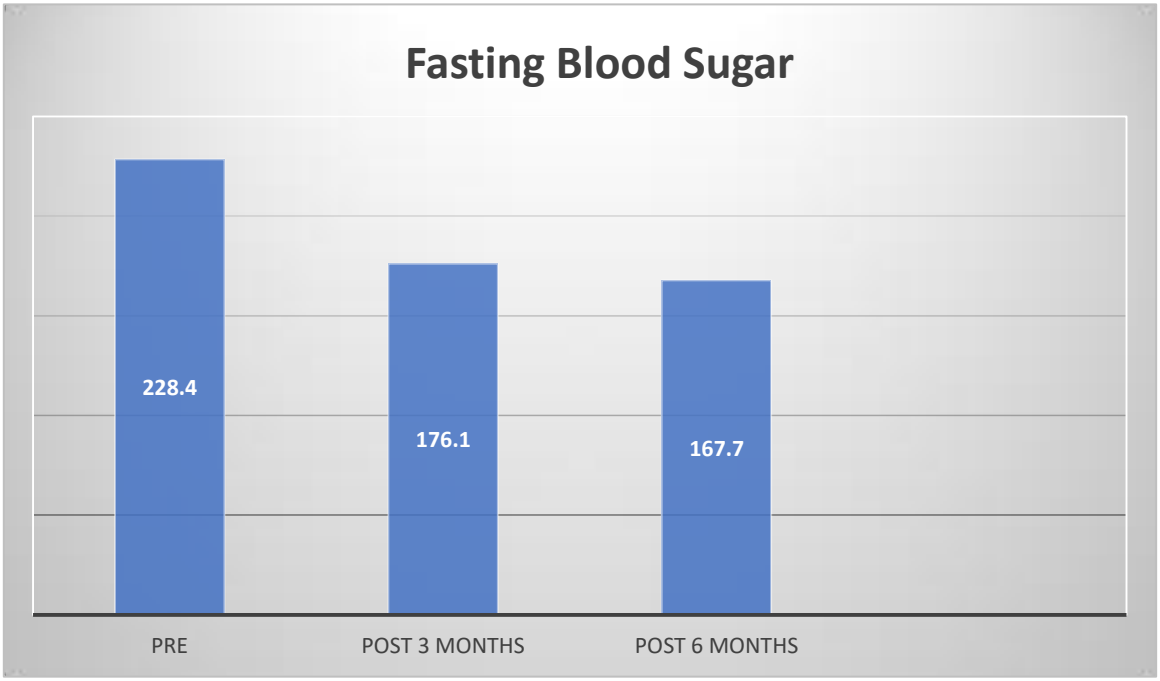

Fig. (4): Fasting blood sugar level for the studied patients pre and post-MI intervention.

Figure (4): Shows statistically significant differences among the study group regarding blood sugar post-MI intervention implementation (P<0.001).

Table (4): Correlations matrix between patients' readiness to change and level of knowledge and blood sugar throughout phases of MI intervention implementation

Items	Patients' readiness to change (n=93)		
	Pre	Post 3 Months	Post 6 Months
Level of knowledge:			
Pre	--	.747**	.658**
Post 3 Months	.747**	--	.859**
Post 6 Months	.658**	.859**	--
Fasting Blood Sugar:			
Pre	--	.390**	.350**
Post 3 Months	.390**	--	.920**
Post 6 Months	.350**	.920**	--

The previous table indicates that there were statistically significant positive correlations between patients' readiness to change and level of knowledge, and blood sugar.

4. DISCUSSION

Diabetes Mellitus is one of the world's most common non-communicable diseases and its associated complications lead to increased disability, diminished life expectancy and significant healthcare costs for almost every society. **(International Diabetes Federation, 2009).** Type 2 diabetes is the majority of diabetes patients worldwide and is mainly due to body weight and inactivity excess. (**World Health Organization, 2018).** As the third leading factor of mortality, diabetes seriously threatens human health worldwide **(Liu etal., 2016)**. Nearly half of all high blood glucose deaths occur before the age of 70. In 2016, the World Health Organization estimates diabetes to be the seventh major cause of death. (**World Health Organization, 2018).** The objective of Healthy People 2010 is to reduce diabetes-related deaths and increase the monitoring frequency of glucose control and chronic complications due to the extent of the burden of the disease. **(Benoit et al., 2005)**.

Lifestyle changes are encouraged as part of diabetes treatment emphasizing healthy eating, regular physical activity, maintaining normal body weight and avoiding tobacco use **(World Health Organization, 2018)**. Evidence supports using MI to encourage positive lifestyle changes among patients with diabetes **(Brobeck et al., 2014)**. So, the aim of this study was to evaluate the efficacy of MI on glycemic control for patients with diabetes.

Part I: Socio-demographic characteristics and history of the disease of patients under study

The results of the present study revealed that less than one-third of patients under study were 40 years and less than 50 years and one-third of them were 50 years and more. This finding was in accordance with ***Foley et al., (2015)***, who mentioned that increasing age increases the risk of diabetes mellitus.

Concerning sex, the findings of this study found that less than two-thirds of patients under study were female. This finding is corresponding with **Karakurt and Kas¸ıkçı, 2012**, who found that two-thirds of patients with type 2 diabetes in his study were women.

Regarding education of the patients, the results of the present study revealed that approximately half of the patients were read/write and basic/intermediate education and more than one-quarter of them were highly educated. This finding was supported by ***Agardh et al., (2011),*** who stated that Type 2 diabetes prevalence increase in population with low education because they have an increased the risk of developing diabetes, as well as of presenting a poorer control of their condition.

In relation to patients' work, the study finding showed that more than half of the patients under study were working. This might be due to the stress of working life which increase blood sugar. This agrees with ***Tayama & Munakata (2016)*** who reported that working long hours could be a risk factor for diabetes in male workers.

As regards BMI, the findings of this study found that more than one-third of patients under study were obese and more than two-fifths of them were overweight. This finding is corresponding with ***Moradi-Lakeh et al (2017)***, who stated that high BMI was the most important risk factor for diabetes in each of the countries in the Eastern Mediterranean Region.

Considering family history, more than two-fifths of patients had a positive family history of diabetes. This finding is corresponding with ***Katulanda, et al (2015)***, who stated that positive family history of diabetes had a graded association in the population because the prevalence increased with the increasing number of generations affected.

In the present study, less than one-third of patients were smokers and less than one-third of non-smokers were exposed to passive smoking. This finding was in accordance with ***Pan et al (2015)***, who reported that smoking (active and passive) are associated with significantly increased risks of type 2 diabetes.

Part II: Effectiveness of motivational interviewing intervention

As regards patients' knowledge assessment of diabetes and its management, the present study findings revealed that there were statistically significant differences in patients' knowledge between pre/post-MI intervention. This might be related to the knowledge acquired from the intervention. These were supported by **Malathy et al., 2011** who found that counselling improved knowledge of diabetes and its management.

In relation to patient's readiness to change, there was a statistically significant difference among the study group through the three phases of assessment which related to following the dietary regimen, which might be attributed to MI intervention implementation. This finding was supported by ***Knight et al., 2015*** who reported that patients in the Action stage endorsed fewer behavioural dietary barriers, more frequent dietary problem-solving, and greater diabetes self-efficacy than patients in the Contemplation and Preparation stages.

Results of the present study indicated that there was a statistically significant difference among the study group regarding exercise. This difference found among the patients under study might be related to MI intervention which changes behaviour especially that those patients are keen to acquire knowledge and skills that hopefully might improve their health. This finding was in accordance with ***Mersal et al., 2012*** who reported that counselling and web-based education improved exercise self-care activities of diabetic patients.

Concerning smoking cessation, this study finding showed that there was a statistically significant difference among the study group pre/post-MI intervention. This finding might be related MI which improves patients' perceptions of the importance of behaviour change and smoking cessation. This result was in accordance with ***Lindson-Hawley et al., 2015***, who mentioned that MI may assist people to quit smoking.

As regards medication regimen, there was a statistically significant difference among the study group pre/post-MI intervention. These differences might be related to the application of the MI intervention which motivates patients to follow medication regiment to avoid complications of diabetes. This finding was congruent with ***Xu et al., 2010*** who stated that the participants were more likely to carry out self-management in relation to taking medication after the program.

In relation to sticking to follow-up for patients under study, this study finding showed that there was a statistically significant difference among the study group pre/post-MI intervention. This difference might be related to the application of the motivational interviewing intervention which motivates patients to maintain follow-up. This finding was supported by ***Ramadas et al., 2018*** who mentioned that follow-up for patients with diabetes improved at the end of the program.

Considering avoidance& management of complications, this study finding showed that, there was a statistically significant difference among the study group pre/post-MI intervention. This result might be related to the knowledge and skills acquired from MI intervention which encouraged patients to apply them through behaviour change. This finding was parallel with ***Jalilian et al., 2014*** who reported that health belief can be effective in the prevention of diabetes complications.

Regarding emotional aspect, there was a statistically significant difference among the studied group pre/post-MI intervention. This might be referred to the MI intervention as patients become knowledgeable about diabetes and they felt more secure, which improving patients' emotional status. This finding is not corresponding with ***Pal et al., 2014*** who mentioned that there was no evidence of significant emotional outcomes for patients with type 2 diabetes who participate in computer-based diabetes self-management interventions.

Concerning psychological and social aspects, this study finding showed that there were statistically significant differences among the study group pre/post-MI intervention. This might be referred to the intervention as it improves patients' confidence, and develop coping skills to effectively manage their diabetes which led to reducing fear and anxiety and improving patients' psychosocial status. This finding was supported by ***Plotnikoff et al., 2000*** who stated that scores on the psychosocial constructs of self-efficacy, were significantly higher for those in the action stage than those in the preaction stage of exercise readiness.

In the present study, there was a statistically significant difference among the study sample regarding spiritual aspect pre/post implementation of the MI intervention. This might be attributed to the MI intervention, as patients benefited from it since his behaviour was changed and they began to strengthen their spiritual beliefs as a coping mechanism in dealing with their disease. This finding was parallel with ***Rabow & Knish 2015*** who reported that palliative care improves spiritual well-being among outpatients.

Part III: Correlation between patients' readiness to change and patient's level of knowledge and fasting blood sugar.

After implementation of the MI intervention, there was a statistically positive correlation between patients' readiness to change and patient's level of knowledge and blood sugar. This finding clarified that applying MI to patients with diabetes has the potential to improve patient's knowledge and to elicit behaviour change that contributes to improving blood sugar. This was supported by ***Ricci-Cabello et al., 2014*** who reported that diabetes self-management educational programs can produce a positive effect on diabetes knowledge and on self-management behaviour, ultimately improving glycemic control.

To summarize, results of this study support the research hypothesis that MI will affect positively on glycemic control for patients with diabetes. This is in agreement with ***Kang and Gu, 2015*** who found that patients with diabetes who received MI self-management program had significant improvement in their glycemic control.

5. CONCLUSION

The study concluded that; Improvement was obvious in the level of knowledge, patients' readiness to change, and reduction of blood sugar of patients under study after attending the motivational interviewing intervention. The findings of the current research thus support the hypothesis that motivational interviews have a positive impact on glycemic control.

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6. RECOMMENDATIONS

Taking the results of this study into account, it is recommended that:

- Programs should be applied to improve self-awareness of patients with diabetes mellitus to increase their overall health and prevent complications of high blood sugar.
- Nurses have an active role in eliciting behaviour change in high-risk lifestyle behaviours as diabetes mellitus.
- An illustrated booklet should be available in the outpatient clinic as a reference for patients with diabetes mellitus. Where the nurses serve as a lawyer to ensure that this information is provided.
- Periodic refreshment training for patients about how to deal with chronic diseases, and lifestyle modification.
- Clarification of the MI's impact on Glycemic Control requires additional research.

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