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Impact of an education program on metabolic indicators for patients undergoing percutaneous coronary intervention in Erbil City

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Abstract---Background: Regular education program provides better medication and diet adherence, leading to better metabolic control. Therefore, the study was conducted to improve metabolic indicators, including body mass index (BMI), blood pressure (BP), glycated hemoglobin (HbA1c), total cholesterol, triglycerides, low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Methods: A quasi-experimental study was conducted among (n=200) coronary artery disease patients undergoing percutaneous coronary intervention at Surgical Specialty Hospital-Erbil Cardiac Center from March 2021 to May 2022. The study participants were randomly assigned to the control and intervention groups. The cardiac health education program was performed for the intervention group; the metabolic indicators were measured for patients before attending the educational program and three months after ending the program. Results: There was a high statistically significant difference between control and intervention groups for adherence to diet ($p<0.00$) and medication ($p<0.00$). After given education program, all metabolic indicators were statistically significant improved (body mass index ($p<0.00$), systolic and diastolic BP ($p<0.00$), HbA1c ($p<0.02$), total cholesterol ($p<0.00$), triglycerides ($p<0.03$), and low HDL $p<0.00$). Conclusion: The study proved that the education program positively affected the metabolic indicators of patients undergoing percutaneous coronary intervention.

Keywords---educational program, metabolic indicators, medication, diet adherence, percutaneous coronary intervention

Introduction

Coronary artery disease (CAD) is one of the utmost important causes of mortality in Eastern Mediterranean countries, Iraq is one of the largest countries in the Middle East, with a number of people of more than 44 million individuals, according to the latest WHO statistics available in 2018 CAD deaths in Iraq reached 32,463 or 18.92% of total deaths [1,2]. The number of individuals suffering from heart disease is increasing year by year worldwide because of improvement in person's living standards and the rising cardiac risk markers [3]. Metabolic syndrome is a principal public health burden globally and involves obesity, high blood pressure, high blood sugar, unhealthy cholesterol levels, and abdominal fat, it is considered a single of the most significant risk factors for CAD [4]. Modification in lifestyle habits, such as following a heart-healthy diet; smoking cessation, regular physical activity, taking heart medication, and a healthy weight can reduce the incidence of coronary heart disease by over 80% [5].

A heart-healthy diet has an important role to act as a key play in the development and prevention of cardiovascular disease (CVD), which is the leading cause of death worldwide [6]. Higher adherence to a healthy diet was associated with a lower CVD risk [7]. Medication adherence and change in lifestyle are two of the most important in the reduction of cardiovascular risk factors among patients with heart disease [8]. Cardio-protective medications can prevent the enlargement of harmful plaque buildup in coronary arteries [9]. These cardiac medications, which consist of antiplatelet drugs, b-blockers, statins, and angiotensin-converting enzyme inhibitors, can thus decrease the risk of death due to CAD [10]. Poor adherence to cardio-protective medications has been linked to increases in healthcare costs due to poor therapeutic outcomes typically requiring major medical interventions, such as coronary angioplasty [11]. Heart disease management programs for CAD patients undergoing PCI, including diet and medication adherence, lead to decreased cardiovascular risk factors [12]. In post-PCI, patients may be exposed to many cardiovascular risk markers (metabolic parameters) that directly affect their quality of life and the development of in-stent restenosis. The present study aimed to evaluate the effect of cardiac health education programs on metabolic indicators in CAD patients undergoing PCI in Erbil City.

Methods

The quasi-experimental study was conducted to evaluate the effect of cardiac health education programs on metabolic indicators in patients undergoing percutaneous coronary intervention at Surgical Specialty Hospital-Erbil Cardiac Center in the Kurdistan Region of Iraq from March 2021 to May 2022. The project was conducted after a pilot study. A purposeful sampling method was used to select (n=200) coronary artery disease patients previously diagnosed by the cardiologist. They were grouped into control and intervention. Inclusion criteria were: the ability to attend an educational program, being present during data collection, needing percutaneous coronary intervention confirmed by coronary angiography, age more than 18 years old, being conscious, and the ability to communicate. Patients who had participated in previous education programs, had professional health qualifications, missed more than 2 educational sessions, died, or encountered any problem making them unable to continue the study were excluded.

The questionnaire consists of patient's demographic and clinical characteristics, Mediterranean diet scale (MDS) consisted of 13 items, questions regarding food consumption frequency and nutrition intake habits considered characteristic of the Mediterranean diet, rated yes or no for each question is scored as 0 or 1 (13). The measurement treatment adherence (MTA) Scale is composed of 7 items, responses to the items on an ordinal scale of six points that vary from responses to always 1, almost always 2, frequently 3, sometimes 4, rarely 5, and never 6 (14). Regarding, blood samples were taken before and after the interventions were collected and transferred to the laboratory immediately to test the glycosylated hemoglobin (HbA1c) by using the Cobas c system, Tina-quant hemoglobin A1c Gen.3 and total cholesterol, triglycerides, LDL and HDL were analyzed on a Cobas Integra 400 Roche Diagnostic. Before starting, all patients underwent education sessions, provided consent forms, and were informed about the aims of the study

The intervention group was given a printed copy of education papers and asked to attend and complete an educational program. In the first session, they received common information about coronary heart disease (definitions, predisposing factors, signs, symptoms of coronary angiography, percutaneous coronary intervention pre- and post-procedure, and home care management). Patients who attended the second session shortly recalled information from the previous session. In this session, they got information about a heart-healthy diet, with a high intake of whole grains, fruits, vegetables, legumes, fish, nuts, monounsaturated/polyunsaturated fat, dairy foods, low intake of pastries, soft drinks, red/processed meat, salt, refined sugar, and saturated/trans fats; explaining carbohydrates of low glycemic index food; indicating portion size for carbohydrate, protein, fat, fruit, and vegetable. Patients were asked if they understood previous sessions and remembered important points in the third session, they were taught about values and adherence to cardiac medication, they were helped to remember the name of the medication by repeating it, and they were asked to feel the sample taken from the bottle.

The purpose of the cardiac medication and its mechanism in the body were described using anatomical diagrams and appropriate analogies. The dosage and frequency were argued using drug calendars. Also, the most common unwanted side effects were described and notified by the physician and health care providers. Further, necessary precautions were discussed for medications that required changing dietary habits. A follow-up was taken after 3 months of the education program for both control and intervention groups to measure adherence to a healthy diet and cardiac medications, as well as metabolic parameters. The collected data were transferred to SPSS version 28 for analysis. Descriptive and inferential statistics were used to find out the results of the study such as frequency, percentage, mean and standard deviation, chi-square; pair and independence t-test, and analysis of covariance; ANCOVA. The P-value of less than 0.05 was considered significant.

Result

This study included 200 CAD patients with ages ranging from 33 to 60 years old; the mean and standard deviation of age in both groups were 47.90±6.8 and 47.15 ±5.36, respectively. The predominant gender was male, and more PCI patients had

a positive family history of heart disease. The majority of patients used more than five medicine (polypharmacy), were non-smokers, and had more than two comorbidities (hypertension, diabetes, and hyperlipidemia), with positive serum cardiac markers: CK-MB (> 6.22ng/ml) and cardiac troponin highly sensitive (> 0.014 ng/m). Most participants had no previous history of PCI, and more than half of them were treated by angioplasty stent through transfemoral access with a single coronary artery affected [Table 1].

Table 1
Demographic and clinical characteristics of control and intervention group

Variables		Control (n=100) %	Intervention (n=100) %	*sig
Age group(years)	33-39	13	18	0.07
	40-46	25	22	
	47-53	47	40	
	54-60	15	20	
	Mean± SD	47.90±6.8	47.15±5.36	
Gender	Male	66	69	0.11
	Female	34	31	
Family history	No	55	56	0.89
	Yes	45	44	
No.medication/days	> 5	76	72	0.15
	≤ 5	24	28	
Cigarette Smoking	Non-smoker	57	60	0.70
	Current Smoker	10	11	
	Ex-Smoker	33	29	
No. comorbidities	0	5	9	0.49
	>2	62	65	
	≤2	33	26	
Comorbidity Hypertension	No	25	30	0.25
	Yes	75	71	
Diabetes mellites	No	33	39	0.95
	Yes	67	62	
Dyslipidemia	No	44	53	0.44
	Yes	56	48	
Indication of PCI	STSEMI	39	40	0.08
	Non-STSEMI	23	24	
	Stable angina	12	11	
	Unstable angina	26	25	
Cardiac enzyme test CK-MB	≤6.22ng/ml	24	28	0.72
	> 6.22ng/ml	76	72	
(hs-cTnT)	≤ 0.014 ng/m	10	13	0.22
	>0.014 ng/m	90	87	
Previous PCI	No	89	93	0.21
	Yes	11	7	
Type PCI	Stent	28	20	0.63
	Balloon	20	21	

	Stent and balloon	52	59	
Route of PCI	Radial	4	2	0.17
	Femoral	96	98	
No. coronary vessels affected	One	47	50	0.10
	Two	43	42	
	Three	10	8	

PCI: percutaneous coronary intervention, CK-MB: Creatine kinase, *hs*-cTnT: cardiac troponin highly sensitive *sig: non-significant value >0.05

The study show that no statistically significant difference between pre-and post-BMI (p=0.46) in the control group, while the mean score in the intervention group significantly dropped from 29.20±3.50 to 26.35±4.09 p=0.00. In examining participants' mean systolic and diastolic blood pressure values, a significant difference was found between the two groups; also, in the intervention group, mean blood pressure values significantly dropped, while in the control group, non-significantly. Glycated hemoglobin (HbA1c) in both control and intervention was poor; in the control group, the mean of HbA1c was not significant (7.13±1.19 to 7.20±1.70 p= 0.72), while in the pre-intervention group, it decreased significantly from 7.13±1.61 to 6.49±3.31, p=0.00, compared to post-intervention. Concerning the lipid profile test, there was no statistically significant difference (p>0.05) in the control group compared to the intervention group, while after receiving the education program, it improved significantly (p <0.00) [Table 2].

Table 2
Comparison of metabolic values of both control and intervention groups

Metabolic values	Control group		*sig	Intervention group		*sig	*sig
	Mean± SD Pre-test	Mean± SD Post-test		Mean± SD Pre-test	Mean± SD Post-test		
BMI	28.37±3.37	28.62±3.52	0.46	29.20±3.50	26.35±4.09	0.00	0.00
BP systolic	148.30±11.14	147.06±12.23	0.37	147.07±13.09	127.74±20.32	0.00	0.00
BP diastolic	90.20±7.55	90.21±9.17	0.99	90.21±9.17	79.35±14.64	0.00	0.00
HbA1c	7.13±1.19	7.20±1.70	0.72	7.13±1.61	6.49±3.31	0.02	0.03
Cholesterol	227.02±46.81	229.32±55.92	0.71	230.11±49.41	187.79±36.84	0.00	0.00
Triglyceride	159.48±23.58	162.05±31.32	0.43	156.17±23.40	148.38±43.05	0.03	0.04
LDL	119.98±21.71	115.66±27.74	0.15	120.63±29.33	91.59±25.98	0.00	0.00
HDL	40.36±10.95	40.87±10.30	0.69	41.09±12.00	51.80±15.90	0.00	0.00

BMI: body mass index, BP: blood pressure, HbA1c: glycated hemoglobin, LDL-C: low-density lipoprotein cholesterol, HDL-C; high-density lipoprotein cholesterol, *sig: significant value <0.05

The study revealed that the total mean score of adherence to the Mediterranean Diet (MD) and Measurement treatment Adherence (MTA) for the pre-test of the intervention group increased statistically significantly after receiving the educational program (5.8±2.5 to 9.5±2.0 p=0.00) and (18.2±7.5 to 28.6±9.9 p<0.00). Consequently, compared to the control group, there was a non-significant difference in MD (p=0.12) and MTA (p=0.94), respectively [Table 3].

Table 3
Comparison of adherence in control and interventions groups

Adherence	Control group			Intervention group			*sig
	Pre-test Mean± SD	Post-test Mean± SD	*sig	Pre-test Mean± SD	Post-test Mean± SD	*sig	
MDS	5.35±2.24	5.79±2.22	0.12	5.88±2.51	9.51±2.02	0.00	0.00
MAT	17.36±6.98	17.41±7.13	0.94	18.20±7.58	28.66±9.94	0.00	0.00

MDS: Mediterranean diet scale, MAT: Measurement treatment adherence, *sig: significant value <0.05

Table 4 provides a comparison between metabolic indicators and diet adherence. Patients adhering to the diet showed significantly lower body mass index, systolic and diastolic blood pressure, and glycated hemoglobin than those non-adhering to dietary recommendations. Also, a highly significant improvement indicated better adherence to diet in total cholesterol and triglycerides levels in patients who received educational programs compared to the control group. Contrarily, there was no significant association between adherence and non-adherence to diet regarding low-density lipoprotein and high-density lipoprotein in the intervention and control groups.

Table 4
Comparison between metabolic values and diet adherence at follow-up

Metabolic values	Adherence to medication					
	Control group		*sig	Intervention group		*sig
	Adherence Mean± SD	Non-adherence Mean± SD		Adherence Mean± SD	Non-adherence Mean± SD	
BMI	28.72±3.56	27.79±3.18	0.41	26.08±4.18	26.42±4.09	0.73
BP systolic	147.87±11.80	140.55±14.27	0.06	125.60±20.55	135.32±17.95	0.04
BP diastolic	90.53±8.81	87.64±11.89	0.33	77.72±14.85	85.14±12.54	0.04
HbA1c	7.14±1.73	7.68±1.42	0.32	5.16±1.74	6.87±3.56	0.00
Cholesterol	229.40±56.62	228.64±52.35	0.97	185.63±33.83	209.09±45.03	0.04
Triglyceride	163.43±31.12	150.91±32.14	0.21	142.29±24.81	169.95±36.51	0.01
LDL	116.01±26.90	112.82±35.22	0.72	86.32±24.53	93.08±26.33	0.27
HDL	40.67±10.19	42.45±11.59	0.59	52.77±19.37	51.53±14.91	0.78

BMI: body mass index, BP: blood pressure, HbA1c: glycated hemoglobin, LDL-C: low-density lipoprotein cholesterol, HDL-C; high-density lipoprotein cholesterol, *sig: significant value <0.05

According to Table 5, after receiving an educational program, the mean systolic and diastolic BP and HbA1c were significantly higher among patients with better medication adherence. Moreover, patients adherent to medications showed a significant improvement in the total cholesterol and triglycerides compared to those non-adherent, while being non-significant in the control group.

Table 5
Comparison between metabolic values and medication adherence at the follow-up

Metabolic values	Adherence Diet					
	Control group			Intervention group		*sig
	Adherence Mean± SD	Non-adherence Mean± SD	*sig	Adherence Mean± SD	Non-adherence Mean± SD	
BMI	28.52±3.43	28.77±3.68	0.73	24.75±4.06	26.82±4.01	0.03
BP systolic	146.87±13.34	147.35±10.50	0.85	125.03±19.93	136.83±19.34	0.01
BP diastolic	91.25±9.40	88.65±8.69	0.17	77.21±14.97	86.52±10.95	0.01
HbA1c	7.07±1.64	7.40±1.80	0.34	5.32±3.39	6.84±3.23	0.04
Cholesterol	230.50±54.86	227.55±58.12	0.80	181.53±32.31	221.78±59.99	0.00
Triglyceride	160.08±27.95	165.00±35.95	0.44	142.06±25.50	169.52±34.07	0.01
LDL	115.55±29.75	115.83±24.78	0.96	94.74±28.18	90.65±25.40	0.51
HDL	42.08±8.98	39.05±11.90	0.15	51.35±15.22	51.94±16.19	0.88

BMI: body mass index, BP: blood pressure, HbA1c: glycated hemoglobin,, LDL-C: low-density lipoprotein cholesterol, HDL-C; high-density lipoprotein cholesterol, *sig: significant value <0.05.

Discussion

Health education is the first step toward improving dietary and medication adherence which can be an effective way to improve patients' metabolic control among patients with coronary heart disease. The result of the study determined that body mass index after giving education to patients decreased significantly compared to post-educational group despite most patients being overweight. It is indicated that the patient who received health education was better adherence to the dietary recommendation to control their body weight, in this study more than half percentage of the patients had diabetes mellites, Most of the Iraqi population had high BMI, and dietary education helps them by modifying type and amount of diet, it was probability be effective in patients who are obese to controlled diabetes It was in line with the study reported that a healthy diet made slight improvements in weight, more supported the study found that significant reduction in weight after receiving an education program [15-17]. Cardiovascular disease prevention guidelines recommend a healthy lifestyle and dietary changes as a key component in lipid-lowering therapy and the risk associated with obesity tends to diminish. An updated Cochrane review of 44 randomized trials with post-education for at least three months duration found that dietary advice reduced total cholesterol and LDL [18]. Moreover, this study has shown that blood pressure and glycated hemoglobin, total cholesterol, and triglyceride reduced significantly after adherence to the dietary recommendation similar results were found in several studies done by [19-21]. In the present study CHD patients after being given education their BMI, blood pressure, glycated hemoglobin, total cholesterol, and triglyceride were significantly higher among patients that better adherence to their medication. It is supported by studies that revealed medication adherence is associated with lowering LDL-TG - TC and weight loss led to a reduction in CVD risk factors in western populations [22-26]. Also, the current study is more supported by a study done by who showed that good glycemic control and controlled blood pressure were found to be higher among the medication adherent [27].

Conclusion

To conclude, the study indicates that regular and repetitive cardiac health education programs provided by the nurses have a positive effect on patient's adherence to medication and dietary recommendations and improve metabolic indicators, leading to the prevention of stent restenosis in coronary artery disease patients undergoing percutaneous coronary intervention.

Financial Disclosure
There is no financial disclosure.

Conflict of Interest
None to declare.

Ethical Clearance
All experimental protocols were approved by the Department of Adult Nursing, College of Nursing, Hawler Medical University, Erbil, Iraq, and all experiments were carried out in accordance with approved guidelines.

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