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Effect of the Iplementation of Nutritional Educational Module on Biochemical andd Physiological Parameters for Patients on Maintenance Hemodialysis

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Abstract

Background: Maintenance hemodialysis is a treatment to filter wastes as urea and creatinine as well as excess water from the blood in chronic renal failure. **Aim**: Evaluate the effect of the implementation of nutritional educational module on biochemical and physiological parameters for patients on maintenance hemodialysis. **Design:** A quasi experimental research design was utilized. **Setting:** This study was conducted at the dialysis center of Damanhour medical national institute. **Subjects:** A convenience sample of sixty adult patients aged from 18 to 60 years on maintenance hemodialysis. **Tools:** Tool I: Socio demographic and clinical data of patients on maintenance hemodialysis structured interview schedule. Tool II: Patients' knowledge regarding hemodialysis treatment and diet. Tool III: Nutritional assessment check list. Tool IV: Biochemical and physiological data. **Results**:There was statistically significance difference post application of the nutritional educational module regarding biochemical indicators as "Hemoglobin, RBCs, WBCs, HCT, urea, creatinine, sodium, potassium, uric acid, albumin, serum protein, calcium, phosphorus, c-reactive protein, and cholesterol.Also statistically significant relation between the study patient's socio demographic, clinical data, biochemical, nd physiological parameters, and positive correlation was found between physiological data with patient age (P=0.017*). **Conclusion**: The nutritional educational module illustrate a positive result regarding over all nutritional assessment, a positive outcome as evidence by biochemical parameters as complete blood count, urea, serum creatinine, sodium, potassium, uric acid, serum albumin, liver derived proteins, serum calcium, phosphorus,c-reactive protein, total cholesterol and transferrin, and also positive result regarding physiological parameters as weight, BMI and blood pressure. **Recommendation**: Replication of the study on non propability sampling.

Keywords: *Biochemical and physiological parameters, Nutritional educational module, Patients on maintenance hemodialysis.*

I. Introduction

End stage renal disease is a progressive, irreversible loss of renal function; it refers to glomerular filtration rate (GFR) less than 15 ml per minute per 1.73 m2 body surface area that is severe enough to be fatal in the absence of dialysis or transplantation.The worldwide prevalence of ESRD has increased in the last few years to about 13-15% with an increased prevalence of diabetes and hypertension. In Egypt the prevalence of ESRD ranged from 32% of individuals in 50-60 years old (61.6% in males and 38.4% in females)(Chopra & Rosner, 2017; Levey et al., 2020).

Maintenance hemodialysis is the process where the patient's blood is circulated through a special filtering machine known as a dialyzer (Soyupek&Akkuş, 2019). It is usually performed 3 times a week for 4-6 hours at a time. It is associated with numerous side effects as renal anemia, protein energy wasting (PEW), muscle weakness, skeletal muscle dysfunction, exercise intolerance, fatigue, decreased activity of daily living, and ultimately, declined biochemical and physiological parameters.

The most common biochemical parameters are plasma concentrations of albumin, serum blood urea nitrogen, transferrin, and other liver derived proteins. C-reactive protein test (CRP) is important for the assessment of inflammatory comorbid conditions. Additional biochemical nutritional markers, with low values indicating poor nutrition, include serum creatinine and total cholesterol. The creatinine level before dialysis is a strong predictor of muscle mass. Acidosis is a strong catabolic factor in uremia and serum bicarbonate monitoring is recommended for routine follow up of the acid base status. Other laboratory analyses include calcium, phosphorus, alkaline phosphate and hemoglobin (Mahaboob& Reddy, 2018; Lamsal, 2020).

Improving biochemical and physiological parameters are major goals of adult patient's management, because adequate nutritional status is important in achieving these goals, careful monitoring of nutritional status is essential. It is a complex concept that cannot be adequately summarized by a single measurement.

Multiple physiological parameters are the scientific study of the functions and mechanisms of

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the body system, which are required to give a complete and accurate picture of nutritional status. It includes vital signs, dietary intake, estimated dry weight, height and Body mass index. BMI (kg/ m2) = weight (kg) / height (m2)(Rijnders et al., 2019; Yamaguchi et al.,2019).

The nutritional guidelines helps the patient to make appropriate food choices to optimize their health. It is difficult for patients to follow a therapeutic diet. Protein should be monitored carefully; too many causes strain on the kidneys and builds up waste products, too little causes malnutrition. The recommended protein intake for should be calculated as 1.2 g/kg of ideal body weight. Electrolytes, such as sodium, potassium and calcium, are also carefully monitored as too little or too much of any of these can cause dangerous symptoms, such as cardiac arrhythmias, edema and bone weaknesses. Phosphorus although not causing immediate damage to the body, at prolonged elevated levels, will cause stiffening and hardening of blood vessels which raises the risk of cardiovascular blockages and death (Vijaya, Aruna, Rao & Mohan, 2019).

The recommended calories intake for each patient is 30–35 kcal/kg of ideal body weight. Moreover, a daily suggested recommended sodium intake amount below 3,000mg, a potassium amount of 2000–3,000mg, and phosphorus intake is 800-1000mg. The fluid recommendation by guidelines is based on fluid output plus 1000ml per day. Dietary intake below the recommended amount is considered to be inadequate (Luis et al, 2016; Beer, Mountford & Boudville, 2018).

Complications of poor nutrition include uremia, increase interdialytic weight gain, hypertension, anemia, hypoalbuminemia, infection, poor wound healing, and hyperkalemia which lead to complications in heart rhythm and finally heart failure(Ikizler&Deger,2017).Protein energy wasting and malnutrition is a common complication among patients on maintenance hemodialysis which is highly prevalent (25-50%) and caused by inadequate dietary intake, anorexia and gastrointestinal disturbances. It is associated with morbidity and mortality (Dekker, Konings, Canaud, Vander, Stuard, Raimann, 2018).

The nutritional educational module involves more information about anatomy and function of a normal kidney, ESRD, hemodialysis treatment, diets and fluid restrictions. This module should begin pre initiation of the hemodialysis session. The duration of the nutritional educational module depends on the patient educational level, the level of knowledge about hemodialysis treatment and therapeutic diets (Mackay, Campbell, Vander- Meij & Wilkinson, 2019).

The role of the nurse as an educator is now becoming more central to their scope of practice than ever before. She must be able to teach patients about a therapeutic diet that should be followed pre/ post hemodialysis sessions; she should evaluate the efficacy of the treatment. (Hand, Burrowes, 2015; Mersal, El-Sedawy& Mersal, 2016).The nurse plays an important role in the assessment and caring for patients, she should recognize cultural, psychosocial and nutritional needs that can affect health care practices. She should assess the dietary intake, evaluate body composition, body weight and body mass index to prevent nutritional health problems and complications (Håkonsen, Pedersen, Bygholm, Thisted & Bjerrum, 2019; Beerappa& Chandrababu, 2019).

Aim of the study

The present study aimed to evaluate the effect of the implementation of nutritional educational module on biochemical and physiological parameters for patients on maintenance hemodialysis.

Research design

Quasi experimental research design was utilized in this study.

Settings

This study was carried out at the dialysis center of Damanhour medical national institute. The dialysis center consists of two floors. In the ground floor, there is one unit that includes 7 beds. In the first floor: there are three units: Two units for hemodialysis patients with negative hepatitis c virus (HCV) one of them 9 beds and the other 10 beds. The third unit receives patients with previous history of HCV with a negative polymerase chain reaction (PCR) which includes 13 beds. The outpatient nephrology clinic consists of two rooms and works from 9:00 am to 1,30pm.The hospital serves El-Behira governorates.

Subjects

A convenience sample of sixty adult patients on maintenance hemodialysis (3-4) sessions per week, divided into two equal groups (control & study), 30 patients in each group, researcher was started with control group. Epi info 7 program was used to estimate the sample size using a population size: 221 monthly, expected frequency 50%, Acceptable error 15%, confidence coefficient 95%.The minimum sample size required were 40 patients.

Inclusion Criteria were as follow:

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- Adult patients diagnosed with ESRD and on maintenance hemodialysis.
- Patients on maintenance hemodialysis (3-4) times weekly for ≥ 6 months with a hemodiafiltration technique.

Exclusion criteria:

- Patients with any associated disorder as metabolic nutritional disorders.
- Patients with Infectious disease as hepatitis B or C.
- Previous renal transplantation recipients.
- Patients who receive immunosuppressive drugs as evidenced from their file.

Tools:

Four tools were used for data collection:

Tool I: Socio demographic and clinical data of patients on maintenance hemodialysis: Structured interview schedule:

This tool was developed by the researcher in Arabic language based on a review of relevant literature to collect baseline data. It was consist of two parts:

Part I: Patient's socio demographic data: This part was used to collect patient's personal data such as age, sex, educational level, marital status, occupation, and residence area.

Part II: Patients clinical data: It was include past and present medical history, surgical history, family history of kidney disease, history of self administered medications, the number of years the patient has lived with kidney disease, date of first hemodialysis session, the number of years on hemodialysis, number of hemodialysis session per week, dietary history related to the name of food intake per day, eating habits, discomfort before and after eating, change in body weight, restriction of food or not.

Tool II: Patients' knowledge regarding hemodialysis treatment and diet: This tool was developed by the researcher based on a review of relevant literature (Alikari et al., 2019). It was be used to assess patient's knowledge. It was include of the following 5 parts:

- **Part I: Description of the normal kidney:** Anatomy and kidney function.
- **Part II: End stage renal disease (ESRD):** Definition, causes, risk factors, clinical manifestations, diagnostic procedures and treatment.
- **Part III: Hemodialysis treatment:** Definition of hemodialysis, benefits, and preparations.
- **Part IV: Diet and fluid intake:** This part was include questions about type of dietary intake, habits and components of diets, restricted food and drink, amount of fluid intake, daily requirements of caloric intake, specific dietary intake e.g. low protein, low phosphorus, restricted sodium, number of meals per day, allowed and prohibited food intake, type of snacks, intake of nutritional supplements.
- **Part V: Complications:** This part was include questions about:
- **Malnutrition complications:** Causes, manifestations, prevention, and management.

Scoring System:

The patient's knowledge answers scored on 3 points Likert scale:

0 = wrong answer or don't know.

1 = correct and incomplete answer.

2 = correct and complete answer.

A total score of every patient was summed up and converted into a percent score. The percent score of this scale was classified as the following:

- Scoring below **50%** was categorized as having poor knowledge level.
- Scoring of **50-75%** was categorized as having a satisfactory knowledge level.
- Scoring more than **75%** or more was categorized as having a good knowledge.

Tool III: Nutritional assessment check list:

This tool was developed by the researcher based on a review of relevant literature(Borges et al., 2017; Kwon et al., 2016) to assess patient's nutritional health status. It was include six parts:

Part I: Food intake recall: It was included items related to dietary recall pre/post dialysis to collect data on the consumption of various food items.

Part II: Fluid intake recall: It was included items related to fluid intake pre/post dialysis days in house hold measurements.

Part III: Gastro intestinal symptoms: It was included experiencing symptoms affecting oral intake as pain on eating, anorexia, nausea, vomiting and diarrhea.

Part IV: Physical signs and symptoms of malnutrition: It was include items as low body weight, anorexia, weakness, fatigue, irritability and hypothermia.

Part V: Clinical manifestation of dehydration: It was included items as headache, weight loss, dizziness, muscle cramps, oliguria, anuria and hypotension.

Part VI: Clinical manifestation of edema: It was included items as arm, leg and ankle swelling, swelling around the eyes, hypertension, dyspnea,

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coughing and weight gain, findings was compared against normal.

Scoring system:

Each item of assessment was compared against normal finding and checked with yes or no.

Tool IV: Biochemical and physiological data:

This tool was developed by the researcher based on a review of relevant literature(Flythe et al., 2019). It was used to assess the effect of nutritional education on biochemical and physiological parameters for patients on maintenance hemodialysis. It was included two parts:

Part I:Biochemical parameters: It was includedall routine lab investigations as complete blood count, blood urea (mg/dl), serum creatinine (mg/dl), sodium (mmol/l), potassium (mmol/l), uric acid (mg/dl), serum albumin (gm/dl), liver derived proteins, serum calcium (mg/dl), phosphorus (mg/dl), c-reactive protein and total cholesterol (mg/dl).Data obtained was compared against normal values.

Part II: physiological parameters: It was included:

A. Vital signs: Vital signs were defined as a measurement of the body's most basic functions including temperature, respiratory rate, pulse, and blood pressure that provide critical information about a person's health and help form the baseline for clinical care. They were useful indicators of nutritional status and recorded pre/post hemodialysis session. Data obtained was compared against normal values (Kurita et al., 2019).

B. Body weight: Is a useful indicator of nutritional status; it was recorded pre/post hemodialysis session. Data obtained was compared against normal values(Bedogni et al., 2019).

C. Standing height: Is another useful indicator of under or over nutrition, most often combined with weight for comparison with ideal values of weight for height. The measurement was taken by a measuring tape pre/post hemodialysis session. The reading was recorded to the nearest 0.1 cm; data obtained was compared against normal values (Tilly et al., 2014).

D. Body mass index: After height and weight were obtained, BMI was estimated by the following equation: BMI (kg/ m^2) = weight (kg) / height (m^2). Data obtained was compared against normal values. Ideal BMI for adult range from 18.5 to 24.9.

Scoring system of BMI is:

- Below 18.5 = under weight.
- Between 18.5 and 24.9 = healthy weight.
- Between 25 and 29.9 = overweight.
- Between 30 and 39.9 = obese (Nuttall, 2015).

II. Method

The study was accomplished as follows:

- Approval from the ethical research committee, faculty of Nursing, Alexandria university.
- An official permission was obtained from the faculty of Nursing, Alexandria University, to the study setting to obtain their permission to collect necessary data.
- An official permission was obtained from the hospital director and head of the departments of the selected hospital setting after explanation of the aim of the study.
- Tool I& II& III& IV was developed by the researcher after reviewing of the relevant literatures.
- The study tools were tested for content validity by a jury of 3 experts in the field of medical surgical Nursing and two experts in Nephrology field. The necessary modifications were done to identify relevance, comprehensiveness as well as clarity.
- The reliability of the tools were tested using cronbachs coefficient alpha tests
- Reliability for tool II was (r = 0.819)
- Reliability for tool III was (r = 0.804).This indicates that tools were reliable.
- A pilot study was conducted on 10% of patients for testing, feasibility, and applicability of tools and modifications were done accordingly, and those patients were excluded from the actual study.
- A convenience sample of 60 adult patients on maintenance hemodialysis was selected and divided into 2 equal groups:
- The control group I was received routine hospital care.
- The study group II was received a nutritional educational module by the researcher as approved by treating physicians.
- The researcher was started first with the control group to prevent data contamination.
- To fulfill the study aim, the nutritional educational module was carried out for the patients in the study group in four phases: assessment, planning, implementation, and evaluation.

Phase I: Assessment phase:

- An initial assessment was carried out for both groups (control & study) to assess patient's knowledge about hemodialysis treatment, diet, and fluid that should be followed, vital signs will be measured, signs of nutritional deficiencies were checked, body weight, height and body mass index was measured according to standard procedures, before application of a nutritional educational module using all tools I.II.III.IV.

Phase II: Planning phase:

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- Based on the data obtained from the initial assessment phase and review of the related literature, the planning of nutritional educational module was developed for each patient by the researcher as approved by treating physician. Power point, posters, and videos were developed for patients of the study group (II).
- A colored booklet was formulated, to be distributed to each patient of the study group (II). It was included the following topics:

○ Simple anatomy of the kidney and hemodialysis treatment.

○ Therapeutic diets for patients on maintenance hemodialysis.

- Allowed and prohibited food and fluid.
- Expected outcomes of the nutritional educational module was included:

○ Improve patient's knowledge.

○ Improve nutritional health status.

○ Maintain normal laboratory investigations as blood urea, creatinine, protein serum values, albumin, CBC and electrolytes.

○ Maintain normal body weight and BMI.

○ Free from any dialysis complications.

Phase III: Implementation phase:

- The control group I was received routine hospital care as measure vital signs, weight the patient and monitor blood pressure pre and post hemodialysis session.
- A nutritional educational module was implemented individually for each patient in group II based on patients assessment in the above mentioned setting in 4 sessions, the first session was done post patients assessment at the middle of hemodialysis session and the second session was done after one week in hemodialysis center of the previous setting and the third session was after one week from the second session and the fourth session was done after educational module. Each session was taken 30-45 minutes.
- Purpose of the study was explained to patients of the study group.
- A colored booklet was distributed to each patients of the study group.

○ **Method of teaching:**

- Face to face discussion was used for the theoretical sessions.
- Media used: PowerPoint slides, videos, posters, and colored booklet were used to support the given information.

1. **The first session:** Was included knowledge about end stage renal disease and hemodialysis as:

○ Anatomy of the normal kidney in simple words.

○ End stage renal disease, definition, causes, signs and symptoms.

○ Hemodialysis treatment, purpose, benefits and complications.

2. **The second session:** Was included health teaching about prohibited and allowed food.

- Health teaching about type and quantity of food as protein and caloric, safe levels of sodium, potassium, phosphorous and fluid intake are important for wellbeing.

3. **Third session:** Was included talking with patients about their misconception about diet and fluid intake pre/ post hemodialysis session.
4. **The fourth session:** Was included health teaching about complications as poor nutrition complications, gastrointestinal complications, and electrolyteimbalance that may occur due to incorrect diet.

Phase IV: Evaluation phase:

- All patients in both groups were evaluated weekly for four weeks.
- Patient's clinical data about fluids and electrolytes imbalance using tool I.
- Patient's knowledge regarding hemodialysis treatment, diet and complications using tool II.
- Patient's nutritional status using tool III.
- The biochemical and physiological parameters outcomes using tool IV.
- The appropriate statistical tests were used to analyze the obtained data. A comparison between the findings of two groups were carried out using appropriate statistical analysis to determine the effect of a nutritional educational module on biochemical and physiological parameters.

III. Result

Table (1): Percentage distribution of patients of both studied groups according to socio demographic data (n = 60)

The majority of patients were in the age group of 50 to 60 years, about (53.3%,73%) were married, (36.7%) was secondary education. There was statistically significant difference between both groups.

Table (2): Distribution of patients of both studied groups according to biochemical parameters (blood) pre/post application of the nutritional educational module

There there was statistically significance difference post application of the nutritional educational module regarding biochemical parameters (blood) as "Hemoglobin, RBCs, WBCs, and HCT".

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Table (3): Distribution of patients of both studied groups according to biochemical parameters (kidney function) pre/post application of the nutritional educational module

There there was statistically significance difference post application of the nutritional educational module regarding biochemical parameters (kidney function) as "urea, creatinine, sodium, potassium, and calcium".

Table (4): Distribution of patients of both studied groups according to biochemical parameters (protein) pre/post application of the nutritional educational module

There there was statistically significance difference post application of the nutritional educational module regarding biochemical parameters (protein) as "uric acid, albumin, and serum protein ".

Table (5): Distribution of patients of both studied groups according to biochemical parameters (minerals) pre/post application of the nutritional educational module

There there was statistically significance difference post application of the nutritional educational module regarding biochemical parameters (minerals) as "phosphorus,c-reactive protein, cholesterol, and transferrin".

Table (6): Distribution of patients of both studied groups according to physiological parameters pre/post application of the nutritional educational module

There was no statistically significance difference between patients of both groups regarding weight and BP post application of the nutritional educational module, and there was statistically significance difference between patients of both studied groups as regard to pulse post application of the nutritional educational module (<0.001*).

Table (7): Correlation between socio demographic, clinical data, biochemical & physiological parameters for the study group

This findings revealed that a statistically significant positive correlation between physiological data with patient age. When age increase, weight also increase (P=0.017*), and it also illustrated a statistically significant negative relationship between the biochemical parameters with sociodemographic, clinical data. As when patients feel discomfort pre/ during and post food intake, it affect negatively on biochemical parameters (p=0.049*).

IV. Discussion

End stage renal disease (ESRD), is the final permanent stage of chronic kidney disease, where as kidney function has declined to the point that the kidneys can no longer function normally. A patient with end stage renal disease must receive dialysis or kidney transplantation to sustain the life. Hemodialysis is a treatment to filter wastes as urea and creatinine as well as excess water from the blood in case of chronic renal failure. This process helps control blood pressure, and balance important minerals such as potassium, sodium and calcium in blood(Nieves-Anaya et al., 2021).

Concerning sociodemographic data, the results of the present study demonstrated that patient's age was almost similar for group I and group II. This may be attributed to the selection criteria of patients' age that ranged from (18-60) years old. Furthermore, the present study illustrated that a higher percentage of the patients were in the age group (50-60) years old.This finding was in line with (Liman et al., 2015) in Nigeria who carried out a study entitled the effect of the nutritional educational program on the biochemical parameters for patients on maintenance hemodialysis, and mentioned that sixty one percent (61%) of patients on maintenance hemodialysis were in the age group between (50-60) years old.

More over, the present study showed that the majority of patients of both studied groups were males. This result was supported by Jahanpeyma, Makhdoomi & Sajadi (2017) who carried out a study entitled the effect of nutrition education program on biochemical parameters among patients with chronic kidney disease undergoing hemodialysis. On contradictory study carried out by Negm et al. (2016) entitled the effect of nutrition education program on health status of hemodialysis patients and clarified that the majority of patients were female.

Also, this study illustrated that almost all patients of both studied groups had poor knowledge level pre application of the nutritional educational module.The finding of the present study may be related to low educational level as the majority of the study group were illiterate, and there was no application of health education in the hemodialysis unit, while there was improvement in mean score of overall knowledge to good knowledge level post application of the nutritional educational module.There was significant difference between both groups, and application of the nutritional educational module. This result was supported by Ramezani et al. (2019)entitled the effect of educational intervention on promoting self care in hemodialysis patients, showed that the majority of patients in the study group had satisfactory and good level of knowledge post application of the educational intervention.

Regarding over all nutritional assessment, this study emphasized improvement mean score of overall nutritional assessment post application of the nutritional educational module, because of improvement of patients knowledge regarding necessary diet, fluid and improve dietary habits.

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There was significance difference between patients of both studied groups, and application of the nutritional educational module. This result was in line with Abd El Aty et al. (2018) who carried out a study entitled the efficacy of nutritional support program on anthropometric measurement and subjective global assessment score among hemodialysis patients, showed that the majority of the study group had improvement of the mean percent regarding nutritional assessment post application of the nutritional educational module.

As for biochemical indicators as "CBC", it was noted that abnormal finding was shown pre application of the nutritional educational module. The majority of patients of both groups revealed low hemoglobin level. The finding of the present study may be related to improper nutrition, poor nutritional habits and low informations about therapeutic diet on hemodialysis. There was improvement of the mean percent post application of the nutritional educational module, there was significance difference between patients of both studied groups and application of nutritional educational module. This was in line with Van Duong et al. (2019) who carried out a study entitled adequate dietary energy intake associates with higher prevalence of metabolic syndrome in different groups of hemodialysis patients, and showed improvement of CBC result post application of the nutritional educational program. On contradictory Miao et al. (2019) in a study entitled the effect of an educational program based on health belief model, and reported that there was no improvement of CBC components post application of educational program.

This study illustrated that application of the nutritional educational module leads to decrease levels of urea, creatinine, sodium, potassium, phosphor, and c-reactive protein.This was in line with Arslan and Tunçalp (2017) on 99 patients under hemodialysis, entitled the effect of diet and fluid education administered to patients of hemodialysis on some parameters, illustrated that nutritional educational program leads to decreased levels of urea, creatinine, sodium, potassium, phosphor,and c-reactive protein. On contradictory to the study by Jahanpeyma et al. (2017) entitled the effect of nutrition education program on biochemical parameters among patients with chronic kidney disease undergoing hemodialysis did not influence calcium, sodium, creatinine, and albumin, urea and phosphor. The reason for these differences can be due to difference in economic, educational, and nutritional status in urban and rural areas. For example, most of the participants in this study had low educational level, socioeconomic status and cultural variables that affect an individual life style.

Regarding physiological indicators for weight, it was observed that the majority of patients had increase in weight pre application of the nutritional education module. The finding of the present study related to increase salt, water intake and poor knowledge about therapeutic diet and fluid, but there was decrease in weight post application of the nutritional educational module because the majority of the study group know daily fluid requirement, and improve knowledge about therapeutic nutrition. There was a significance difference between patients of both groups post application of the nutritional educational module.This was in line with Messenger et al. (2020) who carried out a study entitled renal dietitians perceptions of the value of subjective global assessment, showed that weight decrease post application of the nutritional educational module. On contradictory to other study by de Abreu et al. (2020) entitled comparison of BMI, skin fold thickness, with dual energy x-ray absorptiometry in hemodialysis patients, and clearly noticed that weight and BMI showed no significant changes post nutritional education but slightly increased.

This study showed that the median height, temp and pulse of patients of both studied groups as the same pre/post application of the nutritional educational module.There was no significantly difference with a mean pre/post application of the nutritional educational module.This was in line with the study carried out by Afaghi et al. (2021)entitled the relationship between nutritional status based on subjective global assessment and dialysis adequacy, revealed that the majority of the patients had no changes in their height, temp and pulse as regard pre dialysis and post hemodialysis session.

The present study revealed more than half of the patients of both studied groups were over weight.There was significant reduction in BMI post application of the nutritional educational module, and significant correlation between BMI and interdialytic weight gain.This was in line with the study carried by Limwannata et al. (2021) revealed that there was correlation between body weight and the body mass index. In my opinion, this correlation achieved due to good and effective nutritional guidelines and decrease fluid intake. On contradictory to the study by Cho and Kang (2021) entitled effect of selfcare intervention for controlling interdialytic weight gain, mentioned that BMI remained relatively constant.

It was noted that elevated blood pressure among patients of both studied groups pre application of nutritional educational module because of poor knowledge about diet and fluid and increase salt in diet that lead to increase fluid intake and fluid retention.The median BP of both groups was decreased post application of the nutritional educational module.It was observed that significant change occurred between average systolic and diastolic blood pressures pre/post module.This was in line with Mahmoud et al. (2019) who carried out a study entitled accuracy of sequential blood pressure

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measurements in comparison to ambulatory blood pressure measurements, showed that there was decrease of blood pressure post application of nutritional education.

Also, this study illustrated that there was statistically significant positive relationship between patients sociodemographic, clinical data, and biochemical and physiological parameters. The findings revealed statistically significant positive correlation was found between physiological data with patient age. When age increase, weight also increase. The same scenario was observed by Aghakhani et al. (2017) in a study entitled the effects of appropriate nutrition training in small groups on laboratory parameters in hemodialysis patients, and reported a significant association between sociodemographic characteristics and physiological parameters and confirm that relation between age and physiological parameters specifically weight, illustrated that when age increase weight also increase.

More over, this study illustrated that there was significant negative relationship was found between patients socio demographic, clinical data, biochemical and physiological parameters.As when patients had discomfort pre/during and post food intake, it affect negatively on biochemical parameters.The result of the current study was almost the same as a study carried out by Aboserea et al. (2019) entitled effect of specific nutritional program on patients with chronic renal failure on hemodialysis,reported that there was statistically negative correlation between biochemical data and gastrointestinal disturbance pre /during and after eating.

Nutritional educational module result in improvement of nutritional health status , biochemical and physiological parameters, reduced interdialytic weight gain and reduction in blood pressure. Nutritional status of patients on maintenance hemodialysis receiving nutritional educational module has shown to prevent nutritional complications, improved creatinine, protein serum values, and other biochemical parameters, improve phosphate and calcium levels have proven to be effective. In summary, this study confirmed that the nutritional educational module affect positively on improvement of biochemical and physiological parameters for patients on maintenance hemodialysis.

V. Conclusion

According to the findings of the present study, it can be concluded that the nutritional educational module shows apositive result regarding over all nutritional assessment as there was improvement in mean score of overall items of nutritional assessment regarding diet and fluid.The nutritional educational module illustrate apositive outcome as evidence by biochemical parameters as complete blood count, urea, serum creatinine, sodium, potassium, uric acid, serum albumin, liver derived proteins, serum calcium, phosphorus, c-reactive protein, total cholesterol and transferrin, and also positive result regarding physiological parameters as weight, BMI and blood pressure.

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Table (1): Percentage distribution of patients of both studied groups according to socio demographic data

Items	Control (n =30)		Study (n =30)		χ^2	P
	No.	%	No.	%		
Age (years)						
• 18 -	2	6.7	5	16.7	2.682	^{MC}p= 0.478
• 30-	2	6.7	4	13.3		
• 40-	8	26.7	5	16.7		
• 50 ≤ 60	18	60.0	16	53.3		
Mean ± SD.	47.73±10.55		46.17±12.25			
Gender						
• Male	16	53.3	21	70.0	1.763	0.184
• Female	14	46.7	9	30.0		
Marital status						
• Single	2	6.7	7	23.3	3.871	^{MC}p= 0.283
• Married	22	73.3	16	53.3		
• Divorced	4	13.3	5	16.7		
• Widow	2	6.7	2	6.7		
Level of education						
• Illiterate	14	46.7	8	26.7	15.305*	^{MC}p= 0.002*
• Read and write	4	13.3	1	3.3		
• Primary education	3	10.0	0	0.0		
• Preparatory education	1	3.3	2	6.7		
• Secondary education	8	26.7	11	36.7		
• University	0	0.0	8	26.7		
Occupation						
• Manual	5	16.7	5	16.7	6.529	^{MC}p= 0.163
• Employee	6	20.0	10	33.3		
• Housewife	12	40.0	4	13.3		
• Retired	7	23.3	10	33.3		
• Others	0	0.0	1	3.3		
Place of residence						
• Rural	15	50.0	9	30.0	2.500	0.114
• Urban	15	50.0	21	70.0		
Treatment System (Cost)						
• Health insurance	6	20.0	12	40.0	2.857	0.091
• Private	0	0.0	0	0.0		
• University hospital	0	0.0	0	0.0		
• State expense	24	80.0	18	60.0		

χ^2:**Chi square test** MC: **Monte Carlo**
p: p value for comparing between the studied groups
*: Statistically significant at p ≤ 0.05

Table (2): Distribution of patients of both studied groups according to biochemical parameters (blood) pre/post application of the nutritional educational module

Biochemical data	Control (n =30)										Study (n =30)										Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)	Test of Sig. (p_4)	Test of Sig. (p_5)
	Pre module		Post a week		Post two weeks		Post three weeks		Post month		Pre module		Post a week		Post two weeks		Post three weeks		Post month						
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%					
Hemoglobin																									
• Normal	2	6.7	2	6.7	2	6.7	2	6.7	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0	2	6.7	χ^2=2.069	χ^2=2.069	χ^2=2.069	χ^2=2.069	χ^2=0.000
• Abnormal	28	93.3	28	93.3	28	93.3	28	93.3	28	93.3	30	100.0	30	100.0	30	100.0	30	100.0	28	93.3	(^{FE}p=0.492)	(^{FE}p=0.492)	(^{FE}p=0.492)	(^{FE}p=0.492)	(^{FE}p=1.000)
Mean ± SD.	10.16±1.58		10.16 ± 1.58		10.15 ± 1.56		10.13 ± 1.60		9.96±1.61		10.36±1.67		10.43 ± 1.63		10.44 ± 1.71		10.45 ± 1.72		10.90±1.62		t=0.459 (0.648)	t=0.651 (0.517)	t=0.684 (0.497)	t=0.746 (0.459)	t=2.252* (0.028*)
RBCs																									
• Normal	14	46.7	14	46.7	14	46.7	13	43.3	14	46.7	17	56.7	18	60.0	18	60.0	18	60.0	18	60.0	χ^2=0.601	χ^2=1.071	χ^2=1.071	χ^2=1.669	χ^2=1.071
• Abnormal	16	53.3	16	53.3	16	53.3	17	56.7	16	53.3	13	43.3	12	40.0	12	40.0	12	40.0	12	40.0	(0.438)	(0.301)	(0.301)	(0.196)	(0.301)
Mean ± SD.	3.91 ± 0.49		3.91 ± 0.49		3.90 ± 0.49		3.85 ± 0.43		3.87 ± 0.50		4.06 ± 0.74		4.10 ± 0.76		4.10 ± 0.76		4.12 ± 0.77		4.17 ± 0.63		t=0.900 (0.373)	t=1.104 (0.275)	t=1.198 (0.237)	t=1.646 (0.107)	t=2.002* (0.049*)
WBCs																									
• Normal	26	86.7	26	86.7	26	86.7	27	90.0	23	76.7	27	90.0	27	90.0	27	90.0	28	93.3	29	96.7	χ^2=0.162	χ^2=0.162	χ^2=0.162	χ^2=0.218	χ^2=5.192
• Abnormal	4	13.3	4	13.3	4	13.3	3	10.0	7	23.3	3	10.0	3	10.0	3	10.0	2	6.7	1	3.3	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=0.052)
Mean ± SD.	6.40 ± 1.92		6.40 ± 1.92		6.37 ± 1.88		6.27 ± 1.65		6.22±1.82		6.73 ± 1.58		6.80 ± 1.56		6.91 ± 1.50		7.04 ± 1.36		7.22 ± 1.65		t=0.722 (0.473)	t=0.895 (0.374)	t=1.207 (0.232)	t=1.965 (0.054)	t=2.224* (0.030*)
Hematocrit																									
• Normal	5	16.7	5	16.7	5	16.7	4	13.3	4	13.3	8	26.7	8	26.7	8	26.7	8	26.7	10	33.3	χ^2=0.884	χ^2=0.884	χ^2=0.884	χ^2=1.667(0.	χ^2=3.354
• Abnormal	25	83.3	25	83.3	25	83.3	26	86.7	26	86.7	22	73.3	22	73.3	22	73.3	22	73.3	20	66.7	(0.347)	(0.347)	(0.347)	197)	(0.067)
Mean ± SD.	32.06±4.11		32.06 ± 4.11		31.89 ± 4.17		31.56 ± 4.06		31.74±4.14		33.03±4.89		33.27 ± 4.94		33.44 ± 5.01		33.69 ± 5.03		34.61±4.15		t=0.832 (0.409)	t=1.031 (0.307)	t=1.300 (0.199)	t=1.805 (0.076)	t=2.678* (0.010*)

χ^2:Chi square test FE: Fisher Exact t: Student t-test

p_1: p value for comparing between the studied groups in **pre module** period

p_2: p value for comparing between the studied groups in **post a week** period

p_3: p value for comparing between the studied groups in **post two weeks** period

p_4: p value for comparing between the studied groups in **post three month** period

p_5: p value for comparing between the studied groups in **post month** period

*: Statistically significant at $p \leq 0.05$

Table (3): Distribution of patients of both studied groups according to biochemical parameters (kidney function) pre/post application of the nutritional educational module

Biochemical data	Control (n =30)										Study (n =30)										Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)	Test of Sig. (p_4)	Test of Sig. (p_5)
	Pre module		Post a week		Post two weeks		Post three weeks		Post month		Pre module		Post a week		Post two weeks		Post three weeks		Post month						
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%					
Urea																									
• Normal	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	1	3.3	1	3.3	2	6.7	4	13.3	χ^2=1.017	χ^2=1.017	χ^2=1.017	χ^2=2.069	χ^2=4.286
• Abnormal	30	100	30	100	30	100	30	100	30	100	29	96.7	29	96.7	29	96.7	28	93.3	26	86.7	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=0.492)	(^{FE}p=0.112)
Mean ± SD.	101.72±44.27		101.7 ± 44.27		103.0 ± 43.26		104.0 ± 42.48		105.91±41.81		98.06±50.16		97.09 ± 50.80		95.92 ± 51.47		95.24 ± 52.08		77.86±39.20		t=0.300 (0.765)	t=0.377 (0.708)	t=0.573 (0.569)	t=0.710 (0.481)	t=2.680* (0.010*)
Creatinine																									
• Normal	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	1	3.3	1	3.3	1	3.3	2	6.7	χ^2=1.017	χ^2=1.017	χ^2=1.017	χ^2=1.017	χ^2=2.842
• Abnormal	30	100	30	100	30	100	30	100	30	100	29	96.7	29	96.7	29	96.7	29	96.7	28	93.3	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=1.000)	(^{FE}p=0.492)
Mean ± SD.	8.46 ± 4.15		8.46 ± 4.15		8.67 ± 4.08		8.91 ± 3.95		8.84 ± 4.03		6.58 ± 3.74		6.52 ± 3.75		6.47 ± 3.77		6.28 ± 3.70		4.61 ± 2.78		t=1.844 (0.070)	t=1.898 (0.063)	t= 2.174* (0.034*)	t=2.661* (0.010*)	t=4.719* (<0.001*)
Sodium																									
• Normal	10	33.3	9	30.0	8	26.7	10	33.3	11	36.7	14	46.7	14	46.7	14	46.7	18	60.0	24	80.0	χ^2=1.111	χ^2=1.763	χ^2=2.584	χ^2=4.29*	χ^2=11.59*
• Abnormal	20	66.7	21	70.0	22	73.3	20	66.7	19	63.3	16	53.3	16	53.3	16	53.3	12	40.0	6	20.0	(0.292)	(0.184)	(0.108)	(0.038*)	(0.001*)
Mean ± SD.	145.37 ± 7.41		145.37 ± 7.41		146.33 ± 6.95		147.14 ± 6.63		149.11 ± 7.08		141.83 ± 7.93		141.76 ± 7.87		141.50 ± 7.50		141.10 ± 6.85		139.42 ± 5.54		t=1.785 (0.080)	t=1.826 (0.073)	t=2.592* (0.012*)	t=3.470* (0.001*)	t=5.899* (<0.001*)
Potassium																									
• Normal	10	33.3	10	33.3	10	33.3	12	40.0	6	20.0	18	60.0	18	60.0	19	63.3	19	63.3	27	90.0	χ^2=4.286*	χ^2=4.29*	χ^2=5.41*	χ^2=3.270	χ^2=29.697*
• Abnormal	20	66.7	20	66.7	20	66.7	18	60.0	24	80.0	12	40.0	12	40.0	11	36.7	11	36.7	3	10.0	(0.038*)	(0.038*)	(0.020*)	(0.071)	(<0.001*)
Mean ± SD.	5.64 ± 0.85		5.64 ± 0.85		5.67 ± 0.83		5.65 ± 0.72		6.10 ± 0.71		5.35 ± 1.03		5.36 ± 1.02		5.28 ± 0.93		5.28 ± 0.93		4.67 ± 0.65		t=1.183 (0.242)	t=1.120 (0.267)	t=1.708 (0.093)	t=1.740 (0.087)	t=8.133* (<0.001*)
Calcium																									
• Normal	20	66.7	20	66.7	18	60.0	16	53.3	14	46.7	20	66.7	21	70.0	22	73.3	22	73.3	29	96.7	χ^2=0.000	χ^2=0.077	χ^2=1.200	χ^2=2.584	χ^2=18.47*
• Abnormal	10	33.3	10	33.3	12	40.0	14	46.7	16	53.3	10	33.3	9	30.0	8	26.7	8	26.7	1	3.3	(1.000)	(0.781)	(0.273)	(0.108)	(<0.001*)
Mean ± SD.	8.86 ± 1.15		8.85 ± 1.15		8.74 ± 1.18		8.59 ± 1.19		8.63 ± 1.36		8.63 ± 0.87		8.71 ± 0.90		8.79 ± 0.92		8.88 ± 0.98		9.23 ± 0.57		t=0.870 (0.388)	t=.523 (0.603)	t=0.209 (0.835)	t=1.042 (0.302)	t=2.211* (0.033*)

χ^2:Chi square test FE: Fisher Exact t: Student t-test

p_1: p value for comparing between the studied groups in **pre module** period
p_2: p value for comparing between the studied groups in **post a week** period
p_3: p value for comparing between the studied groups in **post two weeks** period
p_4: p value for comparing between the studied groups in **post three month** period
p_5: p value for comparing between the studied groups in **post month** period
*: Statistically significant at $p \leq 0.05$

Table (4): Distribution of patients of both studied groups according to biochemical parameters (protein) pre/post application of the nutritional educational module

Biochemical data	Control (n =30)										Study (n =30)										Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)	Test of Sig. (p_4)	Test of Sig. (p_5)
	Pre module		Post a week		Post 2 weeks		Post 3 weeks		Post month		Pre module		Post a week		Post 2 weeks		Post 3 weeks		Post month						
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%					
Uric acid																									
• Normal	20	66.7	20	66.7	21	70.0	21	70.0	18	60.0	24	80.0	24	80.0	24	80.0	24	80.0	29	96.7	χ^2=1.364	χ^2=1.364	χ^2=0.80	χ^2=0.80	χ^2=11.88*
• Abnormal	10	33.3	10	33.3	9	30.0	9	30.0	12	40.0	6	20.0	6	20.0	6	20.0	6	20.0	1	3.3	(0.243)	(0.243)	(0.371)	(0.371)	(0.001*)
Mean ± SD.	6.61 ± 2.15		6.62 ± 2.14		6.66 ± 2.06		6.66 ± 2.06		7.67 ± 2.49		7.14 ± 1.45		7.12 ± 1.45		7.07 ± 1.45		7.07 ± 1.37		6.29 ± 1.29		t=1.131 (0.263)	t=1.079 (0.286)	t=0.897 (0.373)	t=0.914 (0.365)	t=2.696* (0.010*)
Albumin																									
• Normal	25	83.3	24	80.0	23	76.7	22	73.3	16	53.3	22	73.3	22	73.3	23	76.7	24	80.0	25	83.3	χ^2=0.884	χ^2=0.373	χ^2=0.000	χ^2=0.373	χ^2=6.239*
• Abnormal	5	16.7	6	20.0	7	23.3	8	26.7	14	46.7	8	26.7	8	26.7	7	23.3	6	20.0	5	16.7	(0.347)	(0.542)	(1.000)	(0.542)	(0.012*)
Mean ± SD.	4.01 ± 0.51		3.97 ± 0.52		3.94 ± 0.53		3.90 ± 0.53		3.82 ± 0.90		3.93 ± 0.80		3.96 ± 0.81		4.01 ± 0.81		4.08 ± 0.79		4.30 ± 0.55		t=0.451 (0.654)	t=0.098 (0.922)	t=0.423 (0.674)	t=1.070 (0.290)	t=2.487* (0.016*)
Serum protein																									
• Normal	23	76.7	23	76.7	23	76.7	23	76.7	18	60.0	23	76.7	24	80.0	25	83.3	25	83.3	29	96.7	χ^2=0.000	χ^2=0.098	χ^2=0.417	χ^2=0.417	χ^2=11.88*
• Abnormal	7	23.3	7	23.3	7	23.3	7	23.3	12	40.0	7	23.3	6	20.0	5	16.7	5	16.7	1	3.3	(1.000)	(0.754)	(0.519)	(0.519)	(0.001*)
Mean ± SD.	7.63 ± 1.29		7.67 ± 1.28		7.71 ± 1.27		7.77 ± 1.25		8.17 ± 1.09		7.54 ± 0.80		7.47 ± 0.77		7.40 ± 0.74		7.35 ± 0.75		7.37 ± 0.67		t=0.304 (0.762)	t=0.736 (0.465)	t=1.169 (0.247)	t=1.577 (0.120)	t=3.420* (0.001*)

χ^2:Chi square test FE: Fisher Exact t: Student t-test

p_1: p value for comparing between the studied groups in **pre module** period

p_2: p value for comparing between the studied groups in **post a week** period

p_3: p value for comparing between the studied groups in **post two weeks** period

p_4: p value for comparing between the studied groups in **post three month** period

p_5: p value for comparing between the studied groups in **post month** period

*: Statistically significant at $p \leq 0.05$

Table (5): Distribution of patients of both studied groups according to biochemical parameters (minerals) pre/post application of the nutritional educational module

Biochemical data	Control (n =30)										Study (n =30)										Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)	Test of Sig. (p_4)	Test of Sig. (p_5)
	Pre module		Post a week		Post 2 wks		Post 3 wks		Post month		Pre module		Post a week		Post 2 wks		Post 3 wks		Post month						
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%					
Phosphorus																									
• Normal	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	2	6.7	4	13.3	6	20.0	–	χ^2=1.017	χ^2=2.069	χ^2=4.29*	χ^2=6.67*
• Abnormal	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	29	96.7	28	93.3	26	86.7	24	80.0		(0.313)	(0.150)	(0.038*)	(^{FE}p=0.024*
Mean ± SD.	6.05 ± 0.88		6.06 ± 0.87		6.09 ± 0.86		6.16 ± 0.80		6.45 ± 0.87		6.79 ± 1.02		6.70 ± 1.13		6.62 ± 1.20		6.53 ± 1.29		5.24 ± 0.95		t=2.997* (0.004*)	t=2.461* (0.017*)	t=1.964 (0.054)	t=1.334 (0.189)	t=5.140* (<0.001*)
CRP																									
• Normal	6	20.0	5	16.7	3	10.0	1	3.3	5	16.7	8	26.7	8	26.7	10	33.3	11	36.7	12	40.0	χ^2=0.373	χ^2=0.884	χ^2=4.81*	χ^2=10.42*	χ^2=4.022*
• Abnormal	24	80.0	25	83.3	27	90.0	29	96.7	25	83.3	22	73.3	22	73.3	20	66.7	19	63.3	18	60.0	(0.542)	(0.347)	(0.028*)	(0.001*)	(0 .045*)
Mean ± SD.	40.03 ± 54.92		40.23 ± 54.81		41.01 ± 54.34		41.62 ± 53.96		45.43 ± 60.73		38.30±48.40		38.18 ± 48.47		37.69 ± 48.76		37.28 ± 48.98		31.57±41.21		U=430.0 (0.767)	U=416.0 (0.615)	U=360.0 (0.183)	U=319.0 (0.052)	U=306.5* (0.034*)
Cholesterol																									
• Normal	19	63.3	19	63.3	18	60.0	18	60.0	17	56.7	20	66.7	21	70.0	21	70.0	21	70.0	28	93.3	χ^2=0.073	χ^2=0.300	χ^2=0.659	χ^2=0.659	χ^2=10.756*
• Abnormal	11	36.7	11	36.7	12	40.0	12	40.0	13	43.3	10	33.3	9	30.0	9	30.0	9	30.0	2	6.7	(0.787)	(0.584)	(0.417)	(0.417)	(0.001*)
Mean ± SD.	182.3 ± 33.82		184.1 ± 32.75		188.1 ± 35.18		188.9 ± 36.07		190.8 ± 31.80		185.7±29.76		181.7 ± 31.32		179.7 ± 32.83		177.5 ± 34.06		171.9±24.90		t=0.413 (0.681)	t=0.290 (0.773)	t=0.949 (0.347)	t=1.266 (0.211)	t=2.561* (0.013*)
Transferrin %																									
• Normal	27	90.0	27	90.0	27	90.0	27	90.0	24	80.0	24	80.0	25	83.3	26	86.7	28	93.3	26	86.7	χ^2=1.176	χ^2=0.577	χ^2=0.162	χ^2=0.218	χ^2=0.480
• Abnormal	3	10.0	3	10.0	3	10.0	3	10.0	6	20.0	6	20.0	5	16.7	4	13.3	2	6.7	4	13.3	(^{FE}p=0.472)	(^{FE}p=0.706)	(^{FE}p=1.000)	(^{FE}p=1.000)	(0.488)
Mean ± SD.	35.24 ± 25.81		34.0 ± 25.50		33.94 ± 25.54		33.80 ± 25.62		33.35 ± 25.40		31.26 ± 15.19		31.84 ± 14.74		32.48 ± 14.19		33.35 ± 13.31		33.94 ± 16.58		t=0.728 (0.470)	t=0.403 (0.689)	t=0.272 (0.786)	t=0.086 (0.932)	t=0.107 (0.916)

χ^2:Chi square test FE: Fisher Exact t: Student t-test

p_1: p value for comparing between the studied groups in **pre module** period

p_2: p value for comparing between the studied groups in **post a week** period

p_3: p value for comparing between the studied groups in **post two weeks** period

p_4: p value for comparing between the studied groups in **post three month** period

p_5: p value for comparing between the studied groups in **post month** period

*: Statistically significant at $p \leq 0.05$

Table (6): Distribution of both studied groups according to physiological parameters pre/ post application of the nutritional educational module

Physiological parameters	Control (n =30)					Study (n =30)					Test of Sig. (p_1)	Test of Sig. (p_2)	Test of Sig. (p_3)	Test of Sig. (p_4)	Test of Sig. (p_5)
	Pre module	Post a week	Post two weeks	Post three weeks	Post month	Pre module	Post a week	Post two weeks	Post three weeks	Post month					
Weight															
Min – Max.	55.0 – 167.0	55.0 – 167.0	55.0 – 167.0	55.0 – 167.0	55.32– 167.0	40.0 – 120.0	40.0 – 120.0	40.0 – 120.0	40.0 – 120.0	42.0 – 114.0	t=0.286	t=0.141	t=0.065	t=0.032	t=0.134
Mean ± SD.	77.02± 20.83	77.02±20.83	77.17±20.80	77.56±20.63	77.39± 20.75	78.47± 18.20	77.73±17.95	77.50±17.96	77.40±17.98	76.73± 17.20	(0.776)	(0.888)	(0.948)	(0.975)	(0.894)
Median	74.25	74.25	74.50	74.50	74.63	77.50	76.50	75.50	74.0	75.0					
Temperature															
Min – Max.	36.80 – 37.0	36.80 – 37.0	36.80 – 37.0	36.80 – 37.0	36.80 – 37.0	36.80– 37.20	36.80–37.20	36.80–37.20	36.80–37.20	37.0 – 37.10	U=396.00	U=384.0	U=372.0	U=360.0	U=362.5*
Mean ± SD.	36.97 ± 0.06	36.97 ± 0.06	36.97 ± 0.06	36.97 ± 0.06	36.97 ± 0.06	36.99 ± 0.07	36.99 ± 0.07	37.0 ± 0.07	37.0 ± 0.07	37.0 ± 0.02	(0.218)	(0.148)	(0.099)	(0.065)	(0.013*)
Median	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0					
Pulse															
Min – Max.	62.0 – 90.0	62.0 – 90.0	62.0 – 90.0	62.0 – 90.0	67.0 – 92.0	66.0 – 96.0	66.0 – 96.0	66.0 – 96.0	66.0 – 96.0	76.0 – 92.0	U=200.5*	U=196.0*	U=	U=	U=175.5*
Mean ± SD.	77.17 ± 8.08	77.17 ± 8.08	77.37 ± 7.97	77.43 ± 8.0	77.97 ± 6.82	84.70 ± 6.43	84.83 ± 6.50	84.87±6.52	85.20 ± 6.52	85.23 ± 3.95	(<0.001*)	(<0.001*)	195.50*	188.50*	(<0.001*)
Median	79.0	79.0 ()	79.0 ()	79.0 ()	78.0	86.0	86.0	86.0	86.50	86.0			(<0.001*)	(<0.001*)	
Respiration															
Min – Max.	12.0 – 82.0	12.0 – 82.0	12.0 – 86.0	12.0 – 86.0	14.0 – 169.0	16.0 – 36.0	16.0 – 36.0	16.0 – 36.0	16.0 – 36.0	18.0 – 35.0	U=276. 0*	U=289.0*	U=310.0*	U=330.50	U=331.50
Mean ± SD.	24.70± 12.46	24.77±12.41	25.20±13.09	25.53±13.24	30.47± 29.03	27.0 ± 5.02	26.53 ± 4.80	26.07 ± 4.52	25.93 ± 4.58	25.73 ± 3.74	(0.010*)	(0.016*)	(0.037*)	(0.075)	(0.078)
Median	22.0	22.0	22.0	22.0	23.0	26.0	26.0	26.0	26.0	26.0					
Blood pressure Systolic															
Min – Max.	100.0– 160.0	100.0–160.0	100.0–160.0	100.0–160.0	110.0– 160.0	90.0 – 190.0	90.0 – 180.0	90.0 – 150.0	90.0 – 150.0	100.0– 160.0	U=373.00	U=399.0	U=434.0	U=441.50	U=401.50
Mean ± SD.	132.3± 16.95	132.33±16.9	133.0±17.84	133.67±17.3	134.0± 13.80	138.0± 21.88	135.67±19.2	133.67±16.9	132.67±16.2	131.0± 12.42	(0.242)	(0.440)	(0.809)	(0.898)	(0.460)
Median	135.0	135.0	135.0	135.0	130.0	145.0	140.0	140.0	140.0	130.0					
Diastolic															
Min – Max.	60.0 – 700.0	60.0 – 700.0	60.0 – 700.0	60.0 – 700.0	70.0 – 100.0	60.0 – 100.0	60.0 – 100.0	60.0 – 100.0	60.0 – 100.0	70.0 – 100.0	U=417.00	U=420.0	U=418.50	U=409.0	U=433.50
Mean ± SD.	104.7± 113.0	104.3±113.1	104.0±113.1	103.3±113.2	84.0 ± 9.32	86.0 ± 12.48	85.67±12.23	85.33±12.24	85.0 ± 12.25	84.33 ± 8.58	(0.612)	(0.644)	(0.627)	(0.526)	(0.793)
Median	90.0	90.0	90.	90.0	90.0	90.0	90.0	90.0	90.0	90.0					

t: Student t-test **t_1: Paired t-test**

U: Mann Whitney test Z: **Wilcoxon signed ranks test**

p_0: p value for comparing between the two studied periods in **each group**

p_1: p value for comparing between the studied groups in **pre nutritional educational module** period

p_2: p value for comparing between the studied groups in **post nutritional educational module** period

*: Statistically significant at $p \leq 0.05$

Table (7): Correlation between socio demographic, clinical data, biochemical ,andphysiological parameters for the study group

Socio demographic data and clinical data	Biochemical data				Physiological parameters							
	Pre		Post one month		Weight				Blood pressure			
					Pre		Post one month		Pre		Post	
	r_s	P	r_s	P	r_s	P	r_s	p	r_s	P	r_s	p
• **Age (years)**	-0.254	0.175	0.008	0.966	0.433*	0.017*	0.433*	0.017*	0.218	0.247	0.204	0.279
• **Level of education**	-0.001	0.996	-0.196	0.300	-0.061	0.749	-0.065	0.734	-0.090	0.634	-0.043	0.822
• **Duration of ESRD**	-0.100	0.599	0.015	0.939	0.072	0.705	0.077	0.684	0.258	0.169	0.282	0.131
• **First hemodialysis session**	0.066	0.731	-0.028	0.884	-0.287	0.125	-0.296	0.112	0.174	0.357	0.126	0.506
• **Improved post hemodialysis**	0.157	0.408	0.067	0.725	0.056	0.767	0.078	0.681	0.104	0.585	0.050	0.795
• **Discomfort pre, during, and post food intake**	-0.363*	0.049*	-0.116	0.542	-0.193	0.308	-0.189	0.316	0.169	0.373	0.185	0.328
• **special kinds of food**	-0.290	0.120	-0.210	0.264	0.014	0.940	0.064	0.737	0.070	0.714	0.237	0.207

r_s: Spearman coefficient
*: Statistically significant at $p \leq 0.05$

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