Nutritional Education for Patients Suffering From Hepatitis C Virus

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Abstract: The aim of the present study is to educate the patients suffering from hepatitis C virus about the right diet for their health and show how such education affect the treatment of the patients of both sexes. Forty healthy volunteers were taken as controls, nearly matching with the patients with regard to socioeconomic status and age range 40-50 years old**.** Patients were selected from those attending the out patients clinic in Port Said Tropical Medicine Hospital, Ministry of Health. Twenty patients of each group were examined. This examination included clinical, biochemical and dietary recall. Before and after blood samples were taken from each subject to determine AST, ALT, bilirubin, serum proteins, Hb, PCV, RBC_S, TG, LDL, HDL and TC. Before and after nutritional education, amounts of the food items consumed were calculated by using the food composition table. Biochemical results revealed that AST, ALT, BIL, globulin, TC were decreased significantly, but TG was slightly decreased after Treatment and nutritional education in all patient subjects. Hemoglobin, PCV, HDL and RBC_S were increased significantly in all patient subjects, whereas LDL was slightly increased in female patients as well as significantly in male patients. Food consumption of calories, carbohydrates, animal protein, total iron, sodium and vitamins (B_6, B_{12}, D, E and niacin) were slightly differ before and after treatment and nutritional education in both patient subjects. Zinc, and vitamins (A and folate) were increased significantly in male subjects after treatment and nutritional education, whereas, Ca and vitamins (B_1, B_2 and C) were decreased significantly. Female patients consumption of total protein, fat(animal and total), Zn, P, Ca, animal iron and vitamin A significantly decreased before and after treatment. As a result of these advice and the follow up certain improvement was recorded as indicated in the means values of calorie and nutrients intake four months after the nutritional education. The changes were statistically significant in most cases. The important point in this respect was the increase awareness of patients about the importance of diet for the quality of their life. With regard to blood analysis for liver functions some improvements as indicated by the results of liver enzymes probably this improvement is due to medical therapy and the adhering to the dietary advice. Based on these results, the study recommends that the expansion of nutritional education programs for patients suffering from HCV with medical treatment is very important in order to reach higher rates of recovery.

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1. Introduction

Liver is both the largest internal organ and the largest gland in the human body. A human liver normally weighs 1.4–1.6 kg, and it is a soft, pinkish-brown, triangular organ (***Cotran et al., 2005***)

Hepatitis is a general term that refers to inflammation of the liver. This condition may results from various infectious and noninfectious etiologies. Infectious etiologies include viral, bacterial, fungal, and parasitic organisms. Viral hepatitis is most commonly caused by hepatitis A virus (HAV), hepatitis B virus (HBV), and hepatitis C virus (HCV). These three viruses can all result in an acute disease process with symptoms of nausea, abdominal pain, fatigue, malaise, and jaundice. Additionally, HBV and HCV can also lead to chronic infection. Patients who are chronically infected may go on to develop cirrhosis and hepatocellular carcinoma (***Wasley et al., 2008***). In 2008, nearly 15% of the population aged 15–59 years had antibodies to HCV, and 10% had chronic HCV infection. An estimate 6 million Egyptians had chronic HCV infection in 2008. Prevalence of chronic HCV infection in Egypt is higher among men than women (12% and 8%, respectively), and increases with age (reaching >25% among persons aged >50 years) as well as, higher among persons residing in rural versus urban areas (12% versus 7%) (***MMWR, 2012***).

Recent data suggest a close relationship between HCV infection and metabolic syndrome. It is possible that HCV infection causes fatty liver disease, a precursor of hepatic steatosis, which is a recognition component of metabolic syndrome .Individual components of metabolic syndrome are independent predictors of mortality in patients with chronic liver disease, including those infected with HCV .Metabolic syndrome is more prevalent among patients with type 2 diabetes and obesity. However,

there is low information about metabolic syndrome in non-obese, non-diabetic patients with chronic hepatitis C (***Lucivalda et al., 2012***).

Moderate to severe malnutrition is a common finding in patients with advanced liver disease. This is extremely significant, considering that malnutrition plays a major role in the pathogenesis of liver injury and has a profound negative impact on prognosis; the prevalence of malnutrition depends on nutrition assessment parameters used, type of liver disease, degree of liver disease and socioeconomic status. Numerous coexisting factors are involved in the development of malnutrition in liver disease. Inadequate oral intake, a major contributor is caused by anorexia, early satiety, and nausea and vomiting associated with liver disease. Other cases of inadequate intake are related to dietary restriction. Mal- digestion and malabsorption also play a role in the malnutrition in liver disease. In addition, altered metabolism secondary to liver dysfunction causes malnutrition in various ways (***Hasse and Mataresa, 2008***). Therefore, the aim of the present study is to educate the patients suffering from viral hepatitis C about the right diet for their health and show how such education affect treatment of patients of both sexes.

2. Subjects and Methods

The present study was done on a group of male and female patients, 40-50 years old, suffering only from hepatitis C virus. They were selected from those attending the out patients clinic in Port Said Tropical Medicine Hospital, Ministry of Health. Twenty patients of each group were examined. This examination included clinical, biochemical and dietary recall.

Forty healthy volunteers (20 of each sex) were taken as controls, nearly matching with the patients with regard to socioeconomic status and age range.

The questionnaire form contains data on the economic and social situation as well as the kind of food for each individual person had been filled by patient and healthy subjects to evaluate their food consumption pattern. Then nutrition education was done for patients through personal interview and by giving them brochures to raise awareness of food. Nutritional status of the patients was assessed by using modified body mass index (BMI) ***(Karen,2010).***

Three times, 24 hour recall was done for each patient and for the control subjects which were recorded twice, before and after four months nutritional education workshop. The amount of the food items consumed was calculated by using the food composition table (***Mayne, 1994***).From patients and healthy controls, blood samples were taken to determine the impact of nutritional status on liver function.

Biochemical investigations:

A fasting blood samples were taken from each patient and control subjects, divided into two parts: one, over heparin for estimation of hemoglobin concentration, hematocrit, red blood cells (RBC_s) count, serum proteins, blood lipids; the other one was left to clot. Serum was separated by centrifugation at 3500 r.p.m. for 15 min, for the estimation of bilirubin and liver function enzymes (AST, ALT).

Aspartate and alanine aminotransferases (AST and ALT, u/dl) activities were determined according to ***Reitman and Frankel, 1957***. Bilirubin is converted to colored azobilirubin by diazotized sulfanilic acid and measured photometrically according to ***Kaplan et al., 1984.*** Serum total proteins concentration was determined as g/dl according to the method described by ***Weissman et al., 1950***, serum albumin was determined as g/dl according to the method described by ***Doumas et al., 1971***, modified by ***Spencer and Price, 1977***, using Spectrophotometer at 630nm. The blood hemoglobin concentration was determined by cyanmethemoglobin method according to the procedure described by ***Betke and Savelsberg, 1950***,using Drabkin's solution as a diluent. Serum Cholesterol was determined according to the method of ***Richmond, 1973***. Serum Triglycerides were determined according to the method of ***Barham and Trinder, 1972***. Serum HDL-cholesterol was determined according to the method of ***Friedewald et al., 1972***. Serum LDL- cholesterol was determined according to the method of ***Assmann et al., 1984***.

3. Results

The mean values ± SE of liver enzymes (AST and ALT) which determined as u/dl and bilirubin mg% in serum of men and women patients before and after nutritional education as compared with control subjects are given in Table 1.It is clear from the results that AST and ALT were significantly high, as expected in patients suffering from HCV, in both men and women comparing with control subjects. By treatment and nutritional education, the levels of the liver enzymes activity in patient's serum still high. After nutritional education a significant decrease was observed only at male patients and not at female patients in respect of AST enzyme whereas significantly different as a result on nutritional education in the case of female patients for ALT enzyme.

In respect of bilirubin, indirect, direct and total were regard between 0.43-0.65 and between 0.28-0.58 for normal female and male, respectively as shown in Table 1.Furthermore, it is evident from the same table that these values were increased in patients as compared with control and occurrence of significant decrease after treatment and nutritional education,

although there level still high as compared with control.

The concentration of serum proteins (globulin, albumin and total) were indicated in Table2. For globulin, the concentration as mg% was varied from 3.15±0.17 and 3.26±0.27 for normal female and male subjects to 4.17±0.07 and 4.05±0.15 for patient female and male subjects, respectively. By treatment and nutritional education the levels of globulin show a significant decrease when compared with patients before treatment. The results reported in Table2 also indicate the same trend when albumin concentration was in account. The results, in general, indicate that serum proteins were high, as expected patients suffering from HCV, in both men and women.

Hemoglobin (Hb), hematocrit (PCV) and red blood cells (RBC_S), as the means ± SE, for patients suffering from HCV and control subjects were indicated in Table3. Data given in this table show that Hb, PCV and RBC_S for normal subjects were low as expected in men and women patients suffering from HCV. By treatment and nutritional education the levels of Hb significantly increased from 9.78±0.24 mg% to13.10±0.14 as a result of treatment and nutritional education, which indicate slight adhearing to nutrition advice for women subjects. Same findings can be observed in the men subjects.

It can be also seen from the data given in Table3, that PCV (%) and RBC_S (mm^3) in patient serum occurrence of significant increase after treatment and nutritional education.

The effect of treatment and nutritional education on the concentration of blood lipids (mg %) in both men and women patients suffering from HCV were studied and the results were presented in Table4. The results indicated that triglycerides (TG) was significantly high in both male and female patients when compared the before treatment with the after treatment subjects.

Unsignificant results were indicated in case of serum level of low density lipoproteins (LDL_C) on female group before and after treatment whereas a significant different in the case of male patients when compared the before and after treatment and nutritional education.

Low density lipoproteins, in general, are decreased as a result of HCV in both men and women, both before and after nutritional education as compared to control subjects.

High density lipoproteins (HDL_C) show the same figure as LDL_C in all subjects except that in the female patient subjects, the effect of treatment and nutritional education was significantly different.

The level of serum total cholesterol indicates higher level in patients as compared with control and occurrence of significant decrease after treatment and nutrition education in both men and women subjects, although there levels still higher as compared with control subjects.

Table 5 illustrate the means ± SE of daily requirement of calories, carbohydrates, proteins and fats of both control and patients of both sex to evaluate the effect of treatment and nutritional education on the subjects suffering from HCV as compared with healthy control.

Regarding to calories the results indicate that calories intake of both men and women patients were higher than the normal cases in both of them. Treatment and nutritional education show unsignificantly values when compared to patient subjects. For female patients the values are lower than control, whereas male patients show higher values. Regarding to carbohydrate same trend can be seen (Table 5).

Table 5 also illustrate the means ± SE of daily intake of proteins for men and women suffering from HCV along with the control subjects and the subjects treated and nutritional educated. The results indicated that animal protein intake of men patients were slightly more than the intake of control subjects, whereas the animal protein intake show about double of the amount of protein in the case of female subjects. The daily intake of fat, of male and women patients suffering from HCV, and the effect of treatment and nutritional education as compared with healthy control and recommended daily allowance (RDA), is given in Table 5. The results showed that fat intake was significantly affected by treatment and nutritional education in the female subjects compared with the values obtained before treatment. On the other hand, the daily intake of fat of male patients was unsignificantly differing after treatment and nutritional education.

Table 6 also illustrate the means ± SE of daily intake of calcium (Ca), phosphorus (P), and zinc (Zn) for men and women suffering from HCV as affected by nutritional education through the treatment. The results were compared with healthy control subjects as well as the patient subjects before nutritional education. The results indicated that Ca intake of both men and women patients were increased than control subjects. Calcium intake also was significantly decreased after nutritional education.

The daily intake of P was higher in female patients but is lower in male patients when compared to control healthy subjects of both sex. Nutritional education resulted in a significant decrease in female patients but unsignificantly decreased in male subjects.

Regarding to the daily intake of Zn, both sex show a higher values as a result of hepatic liver. The results of nutritional education of female patient

subjects show a significantly decreased value, while the male patients show a significantly increased value.

With regard to iron (Fe) the daily intake of healthy female shows a higher value when compared with the male subjects. As a result of virus attack, male patients show higher value than female patients. Nutritional education resulted in unsignificantly decreased values in both sex.

With regard to sodium (Na) daily intake, both men and women patients were slightly more than intake of control healthy subjects. After nutritional education of both sexes the results indicate unsignificantly decreased values in both sexes.

The daily intake of potassium (K) of healthy and patients suffering from HCV as well as the effect of nutritional education was given in Table 6. The daily intake of K of men patient was slightly more than the K intake of control but women patients show slightly lower than control subjects. After nutritional education of both sexes, the female subjects show a significant increase whereas male subjects show a non-significant lower value.

To study the daily intake of soluble vitamins (B_1, B_2, B_6, and B_{12}) and the effect of such requirement as affected by the nutritional education, patients of both sexes suffering from HCV were conducted. Table7 reveals that the daily intake of vitamin B_1 of both men and women was slightly more in patients of both sex subjects than control, and the daily intake of vitamin B_2 of patients was decreased in the case of female whereas increased in the case of male patients compared to control subjects. After nutritional education the vitamins B_1 and B_2 were increased in the case of female subjects, whereas the daily intake of such vitamins was decreased in the educated male subjects. However, the changes were non-significant.

Regarding vitamin B_6, the daily intake of vitamin was decreased and then increased after nutritional education in the case of female compared with control healthy subjects, whereas, this vitamin was increased in men patients and then decreased after nutritional education compared with control subjects. However the decreases or increases were non-significant.

With regard to vitamin B_{12} the daily intake of all subjects was slightly higher than health advice of 2.4 µg daily. The nutritional education cause non-significant increase in vitamin B_{12} in both men and women patients.

Data shown in Table 8 delineate the effect of treatment and nutritional education of daily intake of vitamins (A,C,D,E, folate and niacin) of men and women patients suffering from HCV as compared with healthy control and RDA of both sex.

The results indicated that vitamin A intake were slightly more for women patients whereas slightly low for men patients than intake of control subjects. Daily intake of this vitamin was significantly increased after nutritional education of male patients and significantly decreased for female patients.

The daily intake of vitamin C of female patients was low, but it was more for male patients compared with control subjects. After nutritional education female patients were decreased but male patients were increased. The changes in both sexes were significantly different.

Table 8 also illustrate the means ± SE of daily intake of vitamin D. The daily intake of all patient subjects was lower than the health advice of 10µg.The nutritional education cause significant increase in vitamin D intake on both male and female patients.

The results indicate that Vitamin E was lower in patients in both sexes when compared with control subjects. Treatment and nutritional education resulted in unsignificant change in the vitamin E intake (Table 8).

With regard to the daily intake of folate, men patients were slightly more, but women patients was slightly low when compared to healthy control subjects. These patient results were un-significantly differ for female and significantly higher for male patients after nutritional education. All values reported were lower than the RDA (400µg).

With regard to niacin the daily intake of all subjects was slightly higher than health advice of 14 and 16 mg daily for female and male, respectively. The nutritional education causes un-significant decrease in niacin values in both men and women patients.

4. Discussion

The liver is an organ of primary importance to the body. One cannot survive without a liver. The liver and pancreas are essential to digestion and metabolism. The liver regulates the synthesis, storage and break down of glycogen, and hepatocytes express enzymes that enable them to synthesize glucose from various precursors such as amino acids, pyruvate and lactate (gluconeogenesis). In addition, the liver is a major site of fatty acid breakdown and triglyceride, phospholipids, cholesterol and lipoprotein syntheses. The liver also plays a crucial role in the synthesis and degradation of protein. The liver is involved in the storage, activation and transport of many vitamins and minerals. Consequently, when the liver fails, numerous nutritional problems occur which lead to malnutrition. The studies revealed that malnutrition was common in patients with chronic liver disease of viral etiology and the degree of malnutrition varies according to disease severity (*Shaheen et al., 2009*). Generally the causes of malnutrition in liver disease are complex and multifactorial.

Table (1): Effect of nutritional education on liver enzymes aspartate aminotransferase (AST), alanine aminotransferase (ALT) and bilirubin (indirect, direct and total) for HCV subjects

Groups	Liver Enzymes(u/dl)				Bilirubin (mg %)					
	AST		ALT		Indirect		Direct		Total	
Group1: Normal female	22.00 ± 2.82		27.00 ± 3.08		0.65 ± 0.04		0.43 ±0.14		0.64 ± 0.10	
Group2:	Before	After	Before	After	Before	After	Before	After	Before	After
Female patients	74.13 ±4.2[a]	68.17 ± 7.4[a]	127.09±9.7[a]	54.58 ± 2.7[b]	2.15±0.13[a]	1.32±0.08[b]	3.81±0.12[a]	2.16±0.16[b]	2.01±0.18[a]	1.20±0.09[b]
Group3: Normal male	27.44 ± 2.52		24.84 ± 2.41		0.58 ±0.04		0.28 ± 0.10		0.54 ± 0.14	
Group4:	Before	After	Before	After	Before	After	Before	After	Before	After
Male patients	69.30 ±4.39[a]	51.19±2.61[b]	104.19±8.77[a]	62.57±4.75[b]	2.02±0.22[a]	1.18±0.10[b]	3.63±0.04[a]	2.15±0.16[b]	2.10±0.24[a]	1.30±0.12[b]
*Female	8 - 41		40		0.3 – 0.8		0-3		0.3-1	
*Male	8 - 41		40		0.3 – 0.8		0-3		0.3-1	

*1997-2001 Recommended Dietary Intakes for female and male (25-50and above 50 years).
**Values expressed as mean ± SE. Values at the same column with different letters are significant at $P < 0.05$.

Table (2): Effect of nutritional education on serum proteins (globulin, albumin and total) for HCV subjects

Groups	Serum proteins (mg %)					
	Globulin		Albumin		Total	
Group1: Normal female	3.15±0.17		3.81±0.18		7.00±0.52	
Group2: Female patients	Before	After	Before	After	Before	After
	4.17±0.07[a]	2.79±0.12[b]	2.73±0.12[a]	3.88±0.05[b]	10.08±0.41[a]	7.38±0.17[b]
Group3: Normal male	3.26±0.27		4.10±0.09		6.55±0.58	
Group4: Male patients	Before	After	Before	After	Before	After
	4.05±0.15[a]	3.22±0.11[b]	2.82±0.19[a]	4.09±0.07[b]	9.32±0.23[a]	6.93±0.18[b]
*Female	2- 3.6		3.8-4.6		6-8	
*Male	2- 3.6		3.8-4.6		6-8	

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).
**Values expressed as mean ± SE. Values at the same column with different letters are significant at $P < 0.05$.

Table (3): Effect of nutritional education on hemoglobin, hematocrit (PCV) and red blood cells (RBCs) for HCV subjects

Groups	Hemoglobin (mg %)		PCV (%)		RBCs (mm^3)	
Group1: Normal Female	12.96±0.26		65.20±3.10		4.73±0.02	
Group2: Female patients	Before	After	Before	After	Before	After
	9.78 ±0.24[a]	13.10 ±0.14[b]	27.85 ±3.00[a]	40.61±1.05[b]	3.40 ±0.11[a]	4.45 ±0.12[b]
Group3: Normal male	13.14±.64		38.52±2.45		4.48±.21	
Group4: Male patients	Before	After	Before	After	Before	After
	10.87 ±0.43[a]	13.44 ±0.19[b]	33.20 ±1.87[a]	45 ± 0.63[b]	3.56 ± 0.20[a]	4.41 ± 0.21[b]
*Female	12.5- 16		42 - 52		4.2 - 5.4	
*Male	13.5- 18		37 - 47		4.7 - 6	

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).
**Values expressed as mean ± SE. Values at the same column with different letters are significant at $P < 0.05$.

Table (4): Effect of nutritional education on triglyceride (TG), low density lipoproteins (LDL_C), high density lipoprotein (HDL_C) and total cholesterol (TC) for HCV subjects

Groups	Blood Lipids (mg %)							
	TG		LDL_C		HDL_C		TC	
Group1:Normal female	155.60±24.22		162.80±25.37		65.50±2.53		259.50±30.21	
Group2:Female patients	Before	After	Before	After	Before	After	Before	After
	230.90±18.57[a]	225.18±18.09[a]	133.50±2.89[a]	134.93±4.85[a]	30.30±1.09[a]	41.07±4.36[b]	262.43±19.44[a]	259.67±19.47[b]
Group3:Normal male	74.70±3.70		124.46±5.24		34.70±3.33		174.10±6.16	
Group4:Male patients	Before	After	Before	After	Before	After	Before	After
	205±11.30[a]	201.30±11.57[a]	139.50±4.31[a]	145.01±9.75[b]	31.60±1.03[a]	36.49±1.87[b]	240.85±12.10[a]	236.34±12.47[b]
*Female	> 200		> 110		< 55		> 200	
*Male	> 200		> 110		< 55		> 200	

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).

**Values expressed as mean ± SE. Values at the same column with different letters are significant at $P < 0.05$.

Table (5): Effect of nutritional education on calories, carbohydrate, protein (animal and total) and fat (animal and total) consumption for HCV subjects

Nutrients \ Groups		Group1: Normal female	Group2: Female patients	Group3: Normal male	Group4: Male patients	*Female	*Male
Calories (Kcal)	After	2500.20±28.57	2703±235.00[a]	2760±178	3132±189.00[a]	2200	2900
	Before		2177±217.00[a]		3108±220.00[a]		
Carbohydrate (g)		344.98±25.18	382±42.77[a]	440±40.11	457±23.38[a]	-	-
			321±28.18[a]		465±67.15[a]		
Animal protein	Before	63.56±6.13	64.37±9.52[a]	39.20±11.97	62.22±9.50[a]	50	63
	After		46.66±6.77[a]		62.55±1.05[a]		
Total protein	After	108.14±8.57	108.01±8.48[a]	84.16±8.89	125.06±10.01[a]		
	Before		84.68±6.15[b]		120.07±5.08[a]		
Animal fat	After	40.82±13.16	53.61±9.99[a]	38.28±13.44	44.60±6.33[a]	50	60
	Before		29.54±6.03[b]		38.50±0.80[a]		
Total fat	After	77.58±21.00	80.89±10.40[a]	73.70±9.72	88.51±11.87[a]		
	Before		60.00±13.31[b]		84.85±4.25[a]		

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).

**Values in this table are expressed as mean ± SE. Values at the same row with different letters are significant at $P < 0.05$.

Table (6): Effect of nutritional education on zinc (Zn), phosphorus (P), calcium (Ca) iron (Fe) (animal and total iron), sodium (Na) and potassium (K) consumption for HCV subjects

Minerals \ Groups			Group1: Normal female	Group 2: Female patients	Group 3: Normal male	Group 4: Male patients	*Female	*Male
Zn (mg)	Before		15.52±2.82	17.40±2.19[a]	16.86±1.60	17.34±1.48[a]	8	11
	After			11.96±1.13[b]		20.10±0.90[b]		
P (mg)	Before		1756.46±19.35	1950.03±168.77[a]	1484.34±151.91	1297.51±84.18[a]	700	700
	After			1627.14±135.94[b]		1072.30±94.20[a]		
Ca (mg)	Before		827.12±20.39	1008.97±127.77[a]	707.04±48.95	767.23±56.92[a]	1200	1200
	After			707.48±167.65[b]		648.20±30.50[b]		
Fe (mg)	Animal	Before	9.62±0.84	7.90±1.42[a]	6.32±2.44	8.73±0.14[a]	15	10
		After		5.38±0.52[b]		7.75±2.55[a]		
	Total	Before	23.06±1.27	19.71±1.64[a]	19.40±2.76	29.49±3.14[a]		
		After		18.06±2.44[a]		27.10±7.00[a]		
Na(mg)	Before		4022 ± 32.00	4078.36±405.83[a]	4201± 52.90	4406.80±375.91[a]	-	-
	After			3771.24±419.18[a]		3873.20±111.80[a]		
K(mg)	Before		3586 ± 69.70	2708.47±170.36[a]	2546.86±51.84	3575.38±114.43[a]	-	-
	After			3041.69 ± 474[b]		3293 ± 36.90[a]		

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).

**Values in this table are expressed as mean ± SE. Values at the same row with different letters are significant at $P < 0.05$.

Table (7): Effect of nutritional education on vitamins (B_1, B_2, B_6 and B_{12}) consumption for HCV subjects

Vitamins \ Groups		Group1: Normal female	Group2: Female patients	Group3: Normal male	Group4: Male patients	*Female	*Male
B_1(mg)	Before	1.28±0.13	1.40±0.12[a]	1.36±0.16	1.88±0.14[a]	1.10	1.20
	After		1.42±0.47[a]		1.65±0.15[b]		
B_2(mg)	Before	2.40±0.37	1.01±0.10[a]	2.90±0.26	5.41±1.31[a]	1.10	1.30
	After		1.24±0.61[a]		3.60±0.40[b]		
B_6(mg)	Before	2.02±0.17	1.67±0.16[a]	1.58±0.24	2.21±0.31[a]	1.70	1.50
	After		2.18±0.21[a]		2.60±0.10[a]		
B_{12}(µg)	Before	4.78±0.65	2.06±0.11[a]	3.30±1.21	2.71±1.25[a]	2.40	2.40
	After		3.20±0.63[a]		3.35±1.25[a]		

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).

**Values in this table are expressed as mean ± SE. Values at the same row with different letters are significant at $P < 0.05$.

Table (8): Effect of nutritional education on vitamins (A, C, D, E, folate, and niacin) consumption for HCV subjects

Vitamins \ Groups		Group1:Normal female	Group2:Female patients	Group3:Normal male	Group4: Male patients	*Female	*Male
A(µg)	Before	998.04±44.23	2712.52±199.69[a]	834.66±246.82	549.18±47.77[a]	700	900
	After		786.42±41.47[b]		605.95±17.75[b]		
C (mg)	Before	107.46±32.99	72.81±17.77[a]	114.06±58.65	134.50±29.60[a]	75	90
	After		64.24±16.89[a]		62.75±12.35[b]		
D (µg)	Before	10.68±3.4	8.43±1.30[a]	11.30±5.2	6.00±2.06[a]	10	10
	After		4.34±0.42[a]		6.65±0.55[a]		
E(mg)	Before	42.50±12.12	28.61±7.63[a]	27.54±5.84	22.17±3.95[a]	15	15
	After		22.98±4.21[a]		22.90±3.80[a]		
Folate(µg)	Before	336.48±53.11	329.06±44.36[a]	315.38±36.45	421.74±26.42[a]	400	400
	After		327.60±60.39[a]		467.35±6.45[b]		
Niacin(mg)	Before	18.78±3.43	19.16±2.06[a]	18.40±3.07	24.09±3.11[a]	14	16
	After		14.34±3.42[a]		17.55±2.25[a]		

*1997-2001 Recommended Dietary Intakes for female and male (25-50 and above 50 years).

**Values in this table are expressed as mean ± SE. Values at the same row with different letters are significant at $P < 0.05$.

The world health organization (WHO) reports that approximately 3% of the world population, or approximately 170 million persons, are infected with hepatitis C virus (HCV) with between 3 and 4 million new infections each year. Africa and Asia have the highest report (*Ibrahim and Madian, 2011*). Egypt has the highest prevalence of hepatitis C in the world. Overall, estimates of the HCV rate in general population have ranged between

10 - 20% (*Deuffic-Burban et al., 2005*). Geographically, the hepatitis C prevalence has been shown to be higher in Lower Egypt (Nile Delta) than in Upper Egypt and Lower in urban compared to rural areas (*Mohamed, 2004*).

Unlike other viral forms of hepatitis, the acute phase of HCV is rare. The chronic form, presenting scarce and non-specific symptoms, the infection lasts for decades for a person to develop serious complications (*Hamlyn, 2005*) so the patients may or may not aware of its presence. The treatment for chronic HCV is associated with many unpleasant side effects which are psychological in nature and affecting their quality of life, overall sense of well-being (*Ibrahim and Madian, 2011*). The impacts of HCV seem to be most dramatic in social and physical function, general health and vitality, such as the effects of HCV infection on families, work environments, and on society as a whole.

Despite Egyptian status as the country with the highest levels of HCV infection in the world, most studies have been done on diagnosis and treatment of HCV, and few studies have been done to measure the health related problems as address the educational campaigns about the importance of nutrition, increase awareness of preventing exposure to HCV and modifying people's behave our which may help reduce the burden of disease in Egypt. For this reasons, the aim of this study was to evaluate the impact of nutritional education program on the nutritional and health status among virus hepatitis C patients attending Tropical Medicine Hospital in Port Said.

First impression in this study was that most patients who are diagnosed with HCV infection react with degree of shock, fear and denial. This impression was recorded by *Miyahara et al., 2010*, However, at the beginning, the patient's knowledge revealed that most of them had very little knowledge about the disease and they asked only for medical treatment. The demographic study indicated that all the subjects (patients and control) are resident of Port Said their age were over 40 years from the low to medium socioeconomic status. Nearly about 70% of patients were either illiterate or had low level of education. The knowledge of all patients about mode of disease transmission and healthy diet needed by HCV patients were poor. *Ibrahim and Madian, 2011*, attributed the dissatisfied level of knowledge about HCV to two reasons; first, lack of health educational mass campaigns about the HCV and the way of living healthy with it. Secondary, lower educational level may be associated with a weaker awareness of the seriousness of the disease and a worse ability of the infected patients to cope with the challenges of a chronic condition.

The daily intake of calories and nutrients at the beginning of the study (Table 5) indicated that patient's intake was sufficient in calories and most of nutrients with non-significant differences with the control groups. The patients answer in the questionnaire about the dietary habits indicated that all patients eat the same meals of their families without any change due to special advice. The reason for this may be the patients were in moderate stages of the diseases without any serious complications of HCV. A survey of dietary practice from United Kingdom has shown that patients with cirrhosis were advised to take low protein diet for prolonged periods because medical practitioners thought that low protein diet may prevent hepatic encephalopathy (*Khan et al., 2012)*. However, *Bemeur et al., 2010*, concluded that nutritional support to meet energy and substrate needs and to optimize the removal of circulating ammonia, reduce pro-inflammatory mechanisms and improve antioxidant defenses has the potential to limit the progression of liver dysfunction.

Because of lack of a definite policy about the dietary management of HCV infected patients, as well as the poor awareness about the role of dietary management, the dietary advice used in nutritional education in this study concentrate on advice the patients about avoid smoking and alcoholic, eating healthy and balanced diet and increase the number of meals, reduce salt intake, eating more fresh vegetable and fruits, eating honey, limiting intake of foods rich in iron and limiting the intake of saturated and animal fats. As a result of these advice and the follow up certain improvement was recorded as indicated in the means values of calorie and nutrients intake four months after the nutritional education. The changes were statistically significant in most cases. The important point in this respect was the increase awareness of patients about the importance of diet for the quality of their life.

With regard to blood analysis for liver function at the beginning of the study and four months after nutritional education indicate some improvements in liver function as indicated by the results of liver enzymes (Table1) probably this improvement is due to medical therapy and the adhering to the dietary advice.

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