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Research Article

Effect of Omega 3 Fatty Acids Supplementation on Patency of Arteriovenous Access in Hemodialysis Patients

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Abstract

Background: Maintaining vascular access in hemodialysis patient is considered a challenge since the portal is vulnerable to infection, stenosis, and thrombosis.

Aim of the Work: Evaluate the role of ω-3 fatty acids in preserving the patency of arteriovascular fistulas and grafts in hemodialysis patients.

Patients and Methods: A prospective randomized case control study conducted on 80 chronic hemodialysis patients who are currently undergoing hemodialysis three sessions per week for more than 3 months in our hospital (El-Maadi Liver and kidney transplantation hospital). The study was conducted through a period of time spanning 6 months.They were divided into two groups;

Group 1: (40 hemodialysis patients receiving ω-3 fatty acids for 6 months)

Group 2: (40 hemodialysis patients not receiving ω-3 fatty acids). Patients were assigned to receive fish oil capsules (four 1-g capsules/d) for the 6-month duration of the study. The fish oil was omega 3, which contains 18% eicosapentaenoic acid (EPA) and 12% docosahexaenoic acid (DHA).

Results: In our study there was increase in blood flow in group 1 more than in group 2 but not reaching a statistically significant difference. In our study there was highly significant statistical decrease in blood flow in 1st, 2nd, 3rd, 4th, 5th and 6th month in comparison to Basal in both two groups ($p < 0.001$). In our study there was highly significant statistical increase in URR in group 1 compared to group 2 over the six months period ($p < 0.001$). Conclusion: Among patients with arteriovenous hemodialysis grafts and fistulas, daily ingestion of fish oil leads to highly significant statistical decrease in triglyceride level, total cholesterol level and LDL cholesterol level and increase in HDL cholesterol level. Blood flow also increased but not reaching a statistically significant difference.

Keywords: *omega 3; Arteriovenous Access; Hemodialysis*

Introduction

Because the portal is susceptible to infection, stenosis, and thrombosis, maintaining vascular access in hemodialysis patients is a concern.

Arteriovenous fistulas, arteriovenous grafts, and double lumen, cuffed central venous catheters are among vascular access options for HD patients [1]. Catheter use is linked to an increased risk of infection and may jeopardise the effectiveness of HD. Increased thrombosis, inconsistent blood flows, central venous stenosis, and patient cosmetic concern are all risk factors associated with catheter use [2]. In the United States, 55 percent of patients have an AV fistula, 21% have an AV graft, and 24% have a double lumen dialysis catheter. More than half of all arteriovenous grafts thrombose within a year of insertion, necessitating a salvage treatment in more than seventy percent [3]. Increased age, female gender, hypertension, diabetes mellitus, and positive HIV status are all risk factors for access failure [4].

Various research have sought to uncover a pharmacological way to limit thrombosis-induced vascular access failure, but the majority of them were ambiguous and required more time to evaluate [1]. To lower the cost and morbidity of maintenance HD, new techniques to prevent dialysis access thrombosis are needed. Diets high in omega-3 fatty acids, such as those found in fish oil, may provide such an opportunity. Such diets may have a positive impact on the vascular changes that can lead to synthetic graft thrombosis. [5] revealed the importance of omega-3 fatty acids in protecting vascular access against thrombosis in his work. Other pharmaceutical treatments, such as warfarin, were found to be ineffective, and the study was prematurely ended due to an increase in bleeding episodes in Hemodialysis patients [6].

Patients and Methods

A prospective randomised case control research was undertaken on 80 chronic hemodialysis patients in our institution who have been receiving hemodialysis three times per week for more than three months (El-Maadi Liver & kidney transplantation hospital).
The research was carried out over the course of six months.
They were divided into two groups;

Group 1: (40 hemodialysis patients receiving ω-3 fatty acids for 6 months)

Group 2 (40 hemodialysis patients not receiving ω-3 fatty acids).

Patients were assigned to receive fish oil capsules (four 1-g capsules/d) for the 6-month duration of the study. The fish oil was omega 3, which contains 18% eicosapentaenoic acid (EPA) and 12% docosahexaenoic acid (DHA).

- Lipid profile including total cholesterol, triglycerides, LDL and HDL were recorded as a baseline and then every month.
- Recirculation in vascular access was assessed by urea reduction ratio (URR).
- Doppler techniques baseline to access blood flow was recorded and then every month for 6 months.
- In case of changing in access blood flow for more than 20% of its original value, angiography was required.
- If more than 50% of the lumen was found stenosed by angiography, this was considered an end point.

The study included All adults > 18 years chronic renal failure patients who are undergoing hemodialysis for more than 3 months with either arteriovenous fistula or graft. While Patient with acute renal failure, Diabetic patients, Thrombophilia and all hypercoagulable state, Active malignancy, Pregnancy, Malignant hypertension, Active major bleeding in the prior month, Who receiving more than 2 antiplatelet agents or anticoagulation, Who has surgical revision of a previous access, Any known allergy to fish or fish products were excluded from the study.

Statistical analysis

IBM SPSS statistics (V. 21.0, IBM Corp., USA, 2012) was used for data analysis. Date were expressed as Mean±SD for quantitative parametric measures in addition to both number and percentage for categorized data. . Qualitative data were expressed as frequency and percentage.

The following tests were done

Independent-samples When comparing two means, the t-test of significance was utilised. To compare proportions between qualitative factors, the Chi-square (2) test of significance was applied. When comparing more than two means, use a one-way analysis of variance (ANOVA).

For multiple comparisons between various variables, the Least Significant Difference (LSD) was utilised as a post hoc test. The confidence interval was set at 95%, while the acceptable margin of error was set at 5%.
As a result, the following p-value was declared significant:

Possibility (P-value)

P-values of less than 0.05 were considered significant.

P-values of less than 0.001 were regarded very significant.

P-values greater than 0.05 were deemed insignificant.

Results

The study shows no statistically significant differences between groups as regards the gender, age, duration on hemodialysis and body mass index, smoking and the type of vascular access.

This figure shows highly significant statistical decrease in Cholesterol level in group 1 compared to group 2 over the six months ($p < 0.001$).

This figure shows highly significant statistical decrease in triglycerides level in group 1 compared to group 2 over the six months ($p < 0.001$).

This figure shows highly significant statistical decrease in LDL level in group 1 compared to group 2 over the six months ($p < 0.001$).

This figure shows highly significant statistical increase in HDL level in group 1 compared to group 2 over the six months ($p < 0.001$).

This figure shows increase in blood flow in group 1 more than in group 2 but not reaching a statistically significant difference.

This figure shows highly significant statistical increase in URR in group 1 compared to group 2 over the six months ($p < 0.001$).

This figure shows significant statistical increase in PTH in group 2 compared to group 1 over the six months ($p < 0.05$).

Discussion

Reliable vascular access is required for optimal hemodialysis. The arteriovenous fistula, synthetic arteriovenous graft, and central venous catheter are all current alternatives. More than half of all arteriovenous grafts thrombose within a year after being implanted. Dyslipidemia is common in chronic renal disease, and hypertriglyceridemia and low levels of high density lipoproteins are commonly associated with end-stage renal failure (HDL). Lipid and lipoprotein abnormalities may be one of the main causes of atherosclerosis in these people [7]. Consumption of fish has been linked to a lower risk of sudden cardiac death [8]. Fish oil's Omega-3 fatty acid may protect the myocardium from the negative effects of acute ischemia stress [9]. Our study included 80 chronic hemodialysis patients, 40 of whom were girls (50%) and 40 of whom were males (50%); in contrast, the study by [10] included 24 individuals.

In our study there were no significant differences in age and body mass index between the two groups (53.82 ± 6.528) **vs**. (51.05 ± 10.355) year, (22.77 ± 1.928) **vs**. (22.52 ± 1.839) (table 2), this result agree with the study done by [10].

The fish oil preparation used in our study contained 30% ω-3 fatty acid ethyl esters (18% eicosapentaenoic acid, 12% docosahexaenoic acid), packaged in 1-g soft-gelatin capsules. While in the study done by [10] The fish oil preparation used contained 80% ω-3 fatty acid ethyl esters (44% eicosapentaenoic acid, 24% docosahexaenoic acid, and 10 to 12% other oils), packaged in 1-g soft-gel capsules. The control oil contained 80% ω-6 ethyl esters (corn oil), packaged in 1-g soft-gel capsules. Both preparations contained 0.2 mg/g tbutylhydroquinone and 2 mg/g α-tocopherols (as antioxidants).

Atrophic kidneys were the most prevalent aetiology of end stage renal disease in group 1 and polycystic kidney disease was the most common aetiology of end stage renal disease in group 2, but diabetes was the most common aetiology of end stage renal disease in [3].

In our study, AVF was the vascular access in 82.50 percent of patients versus 17.50 percent who had AVG, which is consistent with the AVF First Breakthrough Initiative (FFBI), which has made significant progress, effectively promoting an increase in national AVF preva-

lence from 32 percent in May 2003 to nearly 60 percent in 2011, with a significant reduction in AVG utilisation. AVF is linked to a longer life expectancy, fewer infections, lower hospitalisation rates, and lower expenses. The first goal of treatment is to reduce TG levels in order to prevent pancreatitis, a potentially fatal consequence of severe hypertriglyceridemia [11].

Over the six-month period in our study, there was a highly significant statistical decrease in total cholesterol level in group 1 compared to group 2 (p0.001) (Figure 1), a finding that agrees with that of [12,13], and [14], but differs from that of [15], which found no change in total cholesterol level. Furthermore, it was completely different from the findings of [16] and [17], which found an increase in total cholesterol level. In our study there was highly significant statistical decrease in triglycerides level in group 1 compared to group 2 over the six months period ($p < 0.001$) (Figure 2), in agreement with results of other studies like study of [18] which shows that The higher dose (3.4 g/d) of EPA+DHA significantly lowered triglycerides and [19] which showed prescription omega-3 fatty acids as monotherapy or as an adjunct to statin therapy have supported its efficacy for improving the lipid profile (reducing triglycerides and triglyceride-rich lipoproteins and raising HDL) in individuals with hypertriglyceridemia or mixed dyslipidemia. In the study done by [20] it showed that omega 3 fatty acids were effective in reducing triglycerides by approximately 30% in patients with very high triglycerides.

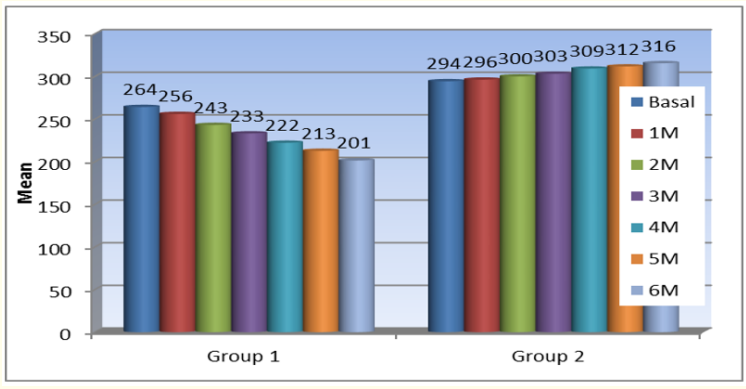

Figure 1: Cholesterol.

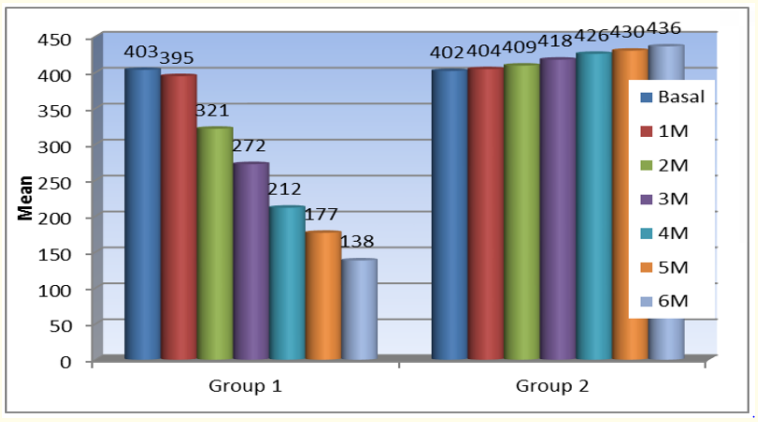

Figure 2: Triglycerides.

In our study there was highly significant statistical decrease in LDL level in group 1 compared to group 2 over the six months period ($p < 0.001$) (Figure 3), and this result agrees with the study done by [13] but this result disagree with the study done by [21] and [22] which showed no change in LDL level.

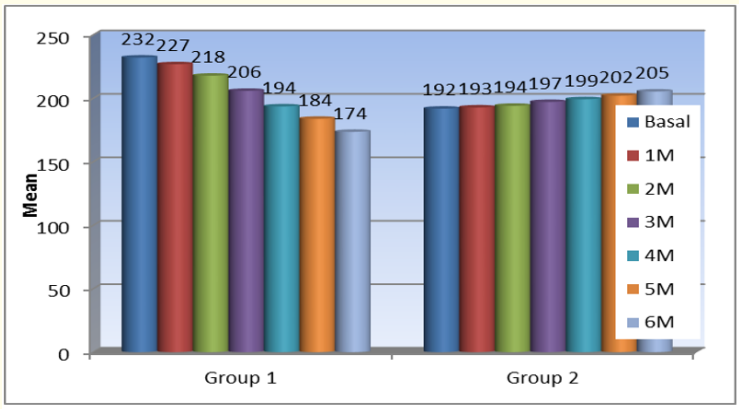

Figure 3: LDL.

In our study there was highly significant statistical increase in HDL level in group 1 compared to group 2 over the six months period ($p < 0.001$) (Figure 4), and this result agrees with the study done by [23] and [24] and disagrees with the study done by [13] which show decrease in HDL level and [25] which showed no change in HDL level in his patients.

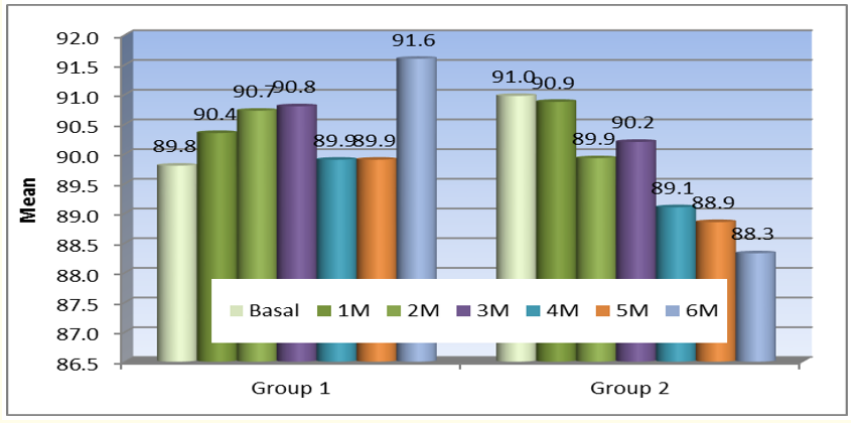

Figure 4: HDL.

In our study there was no significant statistical difference between the two groups as regard hemoglobil level over the six months period ($p > 0.05$), and this result agrees with the study done by [26]

In our study there was no significant statistical difference between the two groups as regard calcium level over the six months period ($p > 0.05$), and this result agrees with the study done by [27].

In our study there was no significant statistical difference between the two groups as regard phosphorus level over the six months period ($p > 0.05$), and this result agrees with the study done by [27].

In our study there was significant statistical increase in PTH in group 2 compared to group 1 over the six months ($p < 0.05$) (Figure 5), and this result disagrees with the study done by [27] which showed no change in PTH level in his patients.

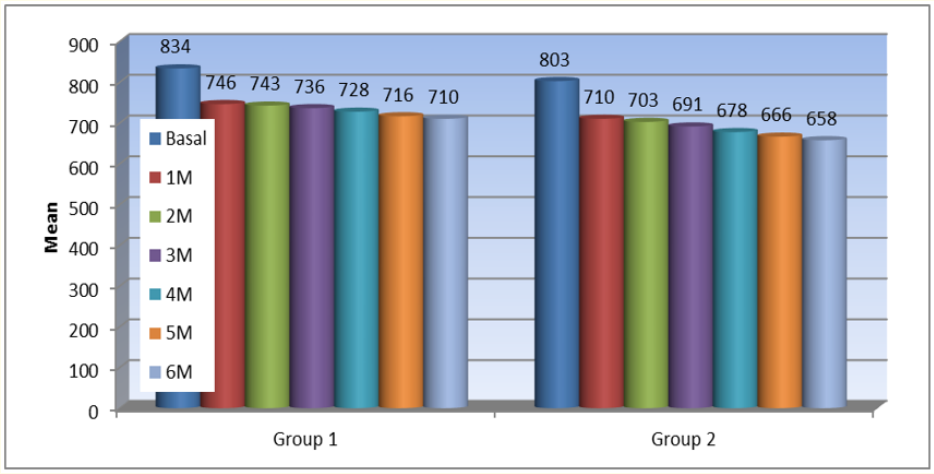

Figure 5: Blood Flow.

In our study, group 1 had a higher increase in blood flow than group 2, but the difference was not statistically significant (Figure 6), which agrees with a study by [28], which found that the vascular effects of fish oil feeding may result in increased blood flow to ischemic and reperfused tissues *In vivo.*

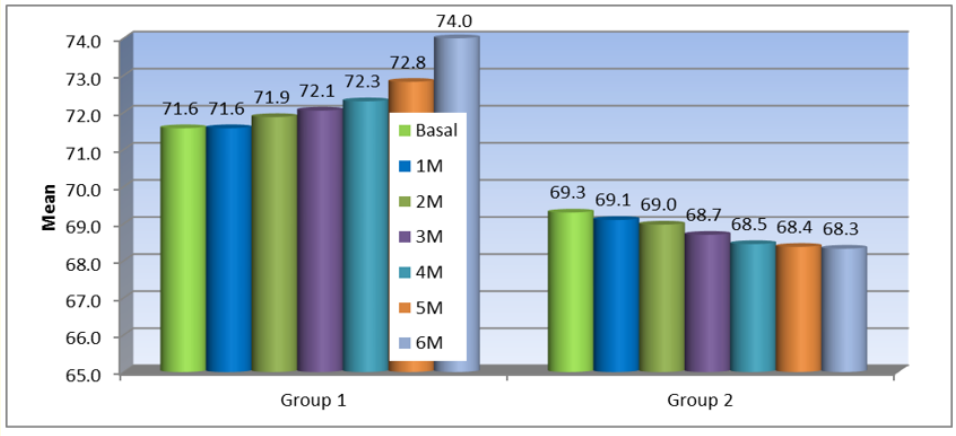

Figure 6: URR.

In our study, in both two groups there was highly significant statistical decrease in blood flow in 1st, 2nd, 3rd, 4th, 5th and 6th month in comparison to Basal ($p < 0.001$) and this result agrees with the study done by [29] which showed that there are important factors that affect the rate of blood flow through a hemodialysis fistula or graft. The performance of the blood pump (ie, the heart) determines the rate and volume of blood flow through the subclavian and brachial arteries. The patient's blood pressure, cardiac ejection fraction, and cardiac rhythm have an impact on the rate of blood flow through the hemodialysis fistula or graft.

In our study there was highly significant statistical increase in URR in group 1 compared to group 2 over the six months period ($p < 0.001$) (Figure 7).

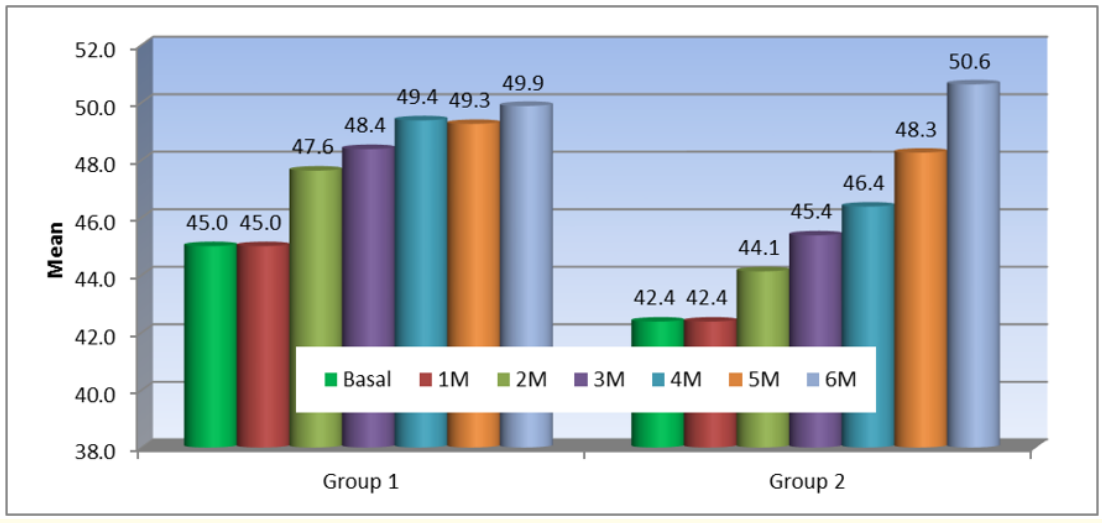

Figure 7: PTH.

During the six months, every hemodialysis session included an examination and auscultation of arteriovenous fistulas and grafts for all patients. All eight individuals had simple clinical indicators such as prolonged bleeding following canula withdrawal and a change in the bruit over the access by auscultation. Any stenotic lesions within the dialysis access can be identified via angiography. In our study Angiography was done to eight patients (10%) (p = 0.456), three of them in group 1 (7.5%) and the remaining five were in group 2 (12.5%), Angiography wasn't performed in the study done by [10].

The three patients in group 1 all were females and they had radiocephalic AVF, AVG and brachiocephalic AVF as a vascular access. The five patients in group 2, four of them were female and they had radiocephalic AVF as a vascular access, the remaining one had brachiocephalic AVF as a vascular access and he is a heavy smoker. And this result agrees with the study done by [30] which showed that the rate of blood flow through a hemodialysis fistula or graft is dependent on the location and specific type of vascular access. Fistulas that are created using the radial artery (3 mm) near the hand have slower rates of blood flow compared to those that are created using the brachial artery (6 mm) near the elbow.

20% of the lumen was found stenosed by angiography in all three patients in group 1, while 30% of the lumen was found stenosed in all five patients in group 2.

Conclusion

Daily ingestion of fish oil results in statistically significant reductions in triglyceride, total cholesterol, and LDL cholesterol, as well as an increase in HDL cholesterol, in patients with arteriovenous hemodialysis grafts and fistulas.

Blood flow increased as well, but not to a statistically significant level.

Conflict of Interest

Authors declare that there is not any financial or personal Conflict of interest.

Authors' Contribution

All Authors have made substantial contributions to the article.

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