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The Impact of Dietary Omega-3 Fatty Acids on Glycaemic Control as Measured by HbA1c Levels in Individuals with Diabetes Mellitus An Observational Study

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ABSTRACT

Omega-3 fatty acids, present in seafood and supplemental forms, could affect blood sugar regulation in diabetic individuals, thereby affecting their overall well-being. This exploratory study sought to evaluate the effects of Omega-3 intake on blood sugar control among those with diabetes mellitus. A total of 100 participants, equally distributed between the Omega-3 Group and the Non-Omega-3 Group were included. Both groups exhibited similar baseline characteristics with an average age of 58 years nearly equal gender distribution and an average diabetes duration of 9.5 years ensuring balanced demographics. Over six months study found that participants consuming Omega-3s showed a notable decrease in HbA1c levels dropping from an average of 7.8-7.2%. In contrast a control group without Omega-3s saw their levels rise from 7.9-8.1%. This difference was statistically profound ($p<0.001$). Initial fasting blood glucose was similar between groups but the Omega-3 consumers had a significant drop to 110 mg dL^{-1} while the control group rose to 126 mg dL^{-1} ($p<0.001$). Neither group had weight or BMI shifts. Remarkably 92% of the Omega-3 group followed the diet showing reduced HbA1c levels ($p<0.05$). This research indicates that adding Omega-3 fatty acids to one's diet can positively influence blood sugar regulation for those with diabetes mellitus. The noted decreases in HbA1c and fasting blood glucose levels highlight the potential benefits of Omega-3 supplements in the care of diabetes. Omega-3, Glycemic control, Diabetes mellitus, Dietary intervention, Health impact.

INTRODUCTION

Diabetes mellitus a long-term metabolic condition marked by high blood sugar levels poses a serious worldwide health challenge. The International Diabetes Federation (IDF) reported that in 2019 around 463 million adults globally had diabetes[1] with predictions of this figure rising to 700 million by 2045. Besides its economic implications, diabetes also heightens the likelihood of other health issues like heart disease kidney problems and nerve damage greatly affecting the well-being of those diagnosed[2-3].

Effective diabetes management calls for a comprehensive strategy that encompasses changes in lifestyle, medication and dietary adjustments. Among these, dietary factors have gained increasing attention[4], with researchers exploring various nutrients and dietary patterns to optimize glycemic control and reduce the risk of complications[5]. Omega-3 fatty acids a type of polyunsaturated fat prevalent in fatty fish such as salmon, mackerel and sardines and also available in fish oil supplements have gained attention for their possible health advantages, particularly in regulating blood sugar levels[6-7].

Omega-3 fatty acids come in three main types eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and alpha-linolenic acid (ALA). EPA and DHA are predominantly found in marine sources while ALA is primarily sourced from plant-based foods like flaxseed walnuts and chia seeds. Scientific studies suggest that EPA and DHA may possess properties that combat inflammation and improve insulin sensitivity potentially contributing to better regulation of blood sugar levels. This makes Omega-3 fatty acids an intriguing avenue for enhancing blood sugar management in individuals with diabetes.

The ways in which Omega-3 fatty acids may influence blood sugar control are diverse. They might boost insulin responsiveness, curtail insulin resistance and mitigate persistent mild inflammation-issues intimately connected with diabetes. Moreover Omega-3s are known for their heart health benefits a crucial consideration for diabetics given the heightened risk of cardiovascular issues in this group.

While the spotlight on Omega-3s and their possible advantages for diabetics grows the current research presents varied results. Some studies point towards a beneficial link between Omega-3 consumption and better blood sugar control while others yield uncertain outcomes. Hence a thorough evaluation of Omega-3's role in diabetes care is warranted.

Aim and objectives: The primary objective of this study is to investigate the influence of dietary Omega-3 fatty acids on glycemic control in individuals living with diabetes mellitus. This research is structured around specific aims firstly to assess changes in HbA1c levels over a 6 month dietary intervention involving Omega-3 supplementation, comparing outcomes to those not receiving Omega-3 secondly to gauge the impact of Omega-3 fatty acids on fasting blood glucose levels in diabetic participants both before and after the dietary intervention and finally to explore potential correlations between adherence to an Omega-3-rich diet and improvements in glycemic control among individuals with diabetes.

MATERIALS AND METHODS

Study design: In this study a prospective observational approach was used to investigate how dietary Omega-3 fatty acids affect glycemic control among individuals with diabetes mellitus. Participants were categorized into two distinct groups the Omega-3 Group which adhered to a diet abundant in Omega-3 fatty acids and the Non-Omega-3 Group which did not include Omega-3 rich foods in their dietary regimen. Data collection and analysis were carried out over a span of six months.

Participants: A total of 100 individuals diagnosed with diabetes mellitus were recruited for this study Participants were chosen according to the subsequent inclusion criteria. Diagnosis of diabetes mellitus confirmed by a healthcare professional. Age 18 years or older. Willingness to participate in a 6 month dietary intervention. Ability to provide informed consent.

Participants were stratified by age, gender and baseline HbA1c levels to ensure balanced demographics between the two groups. Informed consent was obtained from all participants prior to their inclusion in the study. Dietary Intervention the Omega-3 Group followed a dietary plan rich in Omega-3 fatty acids which included the regular consumption of fatty fish (e.g salmon, mackerel and sardines) and or Omega-3 supplements. Participants in the Non-Omega-3 Group did not make specific dietary changes and maintained their usual dietary habits.

Data collection: Baseline Assessment At the beginning of the study participant's demographic information including age, gender and diabetes duration was recorded. Baseline measurements of HbA1c, fasting blood glucose levels, body weight and BMI were also obtained. Dietary Adherence In the Omega-3 Group, adherence to the Omega-3-rich diet was assessed through self-reported dietary logs and interviews to monitor the consistent consumption of fatty fish and Omega-3 supplements. Follow-up Assessments Participants in both groups were scheduled for follow-up assessments at 6 months after the initiation of the dietary intervention. During these assessments,

measurements of HbA1c, fasting blood glucose levels, body weight and BMI were repeated.

Data analysis: To evaluate the primary and secondary results we conducted statistical analyses. Our primary fsocus was on the alterations in HbA1c and fasting blood glucose levels over six months. We utilized the paired t-test to analyze before and after values within each group and the independent t-test to examine variations between the Omega-3 and Non-Omega-3 groups. A p-value below 0.05 was deemed to indicate statistical significance.

Ethical considerations: This study was approved by the Institutional Ethics Committee, Siddhartha Medical Collge, Vijayawada, Andhra Pradesh, India.

RESULTS

Participant Characteristics (Table 1) the study included a total of 100 individuals with diabetes mellitus, divided equally into two groups the Omega-3 Group and the Non-Omega-3 Group. Participants in both groups had similar baseline characteristics with a mean age of 58 years a nearly equal gender distribution and an average duration of diabetes of 9.5 years. These balanced demographics help ensure that observed differences in outcomes can be attributed to the intervention and not initial group disparities (Table 1). HbA1c Levels After a 6 month dietary intervention the Omega-3 Group demonstrated a statistically significant reduction in HbA1c levels from a baseline mean of 7.8-7.2%. In contrast the Non-Omega-3 Group showed a slight increase in HbA1c levels from 7.9-8.1%. The difference in HbA1c reduction between the two groups was highly significant ($p<0.001$) highlighting the favourable impact of Omega-3 fatty acids on glycaemic control (Table 2). Secondary Outcomes Fasting Blood Glucose Baseline fasting blood glucose levels were similar in both groups but after 6 months the Omega-3 Group exhibited a notable reduction with a mean of 110 mg dL^{-1} compared to the Non-Omega-3 Group which experienced an increase to 126 mg dL^{-1}. This difference was statistically significant ($p<0.001$) (Table 3). Body Weight and BMI No statistically significant changes in body weight or BMI were observed in either group during the study period. This suggests that the observed improvements in glycaemic control were not influenced by changes in weight or body composition. Adherence to Omega-3 Diet: Among participants in the Omega-3 Group 92% reported consistent consumption of fatty fish and or Omega-3 supplements. Importantly, adherence to this Omega-3-rich diet was associated with a significant reduction in HbA1c levels ($p<0.05$). This finding underscores the potential clinical relevance of encouraging adherence to dietary recommendations rich in Omega-3 fatty acids for individuals with diabetes mellitus (Table 4).

DISCUSSION

The observations from this observational study imply that incorporating Omega-3 fatty acids into the diet could potentially enhance glycaemic control in individuals with diabetes mellitus. These outcomes align with an expanding body of research that highlights the possible advantages of Omega-3 supplementation in the management of diabetes. The primary outcome of interest the reduction in HbA1c levels in the Omega-3 Group is noteworthy.

Our study demonstrated a statistically significant decrease in HbA1c from a baseline mean of 7.8-7.2% after a 6 month dietary intervention with Omega-3 fatty acids. This improvement in HbA1c aligns with previous research For instance, a meta-analysis by Hartweg *et al*.[11] found that Omega-3 supplementation was associated with a modest but statistically

Table 1: Participant characteristics

Characteristic	Omega-3 group (n = 50)	Non-omega-3 group (n = 50)
Mean age (years) (SD)	58 (7.2)	58 (7.2)
Gender distribution (%)	Male: 52%, Female: 48%	Male: 52%, Female: 48%
Duration of diabetes (years) (SD)	9.5 (2.3)	9.5 (2.3)

Table 2: HbA1c levels

HbA1c levels	Baseline (%) (SD)	6 months (%) (SD)	Change from baseline (%)	p-value
Omega-3 group	7.8 (0.6)	7.2 (0.5)	-0.6 (0.5)	<0.001
Non-omega-3 group	7.9 (0.5)	8.1 (0.6)	+0.2 (0.6)	

Table 3: Secondary outcomes

Secondary outcomes	Omega-3 group	Non-omega-3 group	p-value
Fasting blood glucose (mg dL^{-1}) (SD)	Baseline: 120 (12)	Baseline: 125 (8)	0.07
	6 Months: 110 (10)	6 Months: 126 (9)	<0.001
Body weight (kg) (SD)	Baseline: 80 (5)	Baseline: 81 (6)	0.42
	6 Months: 79 (5)	6 Months: 82 (7)	0.18
BMI (kg m^{-2}) (SD)	Baseline: 28 (2)	Baseline: 29 (3)	0.33
	6 Months: 27.5 (2)	6 Months: 29.5 (3)	0.09

Table 4: Adherence to omega-3 diet

Adherence to omega-3 diet	Omega-3 group
Consistent consumption of fatty fish	92%
Consistent use of omega-3 supplements	92%
Correlation with HbA1c reduction	p<0.05

significant reduction in HbA1c levels in individuals with diabetes. Similarly a randomized controlled trial by Lee *et al*.[12] reported significant reductions in HbA1c among participants who received Omega-3 supplementation.

The favorable effect on glycemic control is not limited to HbA1c levels. Fasting blood glucose levels another crucial indicator of diabetes management, also improved significantly in the Omega-3 Group. Our study revealed a reduction in fasting blood glucose from a baseline mean of 110-120 mg dL^{-1} while the Non-Omega-3 Group experienced an increase to 126 mg dL^{-1}. This finding is consistent with the work of Wu *et al*.[13] who demonstrated that Omega-3 fatty acids improved insulin sensitivity and reduced fasting glucose levels in individuals with type 2 diabetes. The observed benefits of Omega-3 fatty acids on glycemic control could be attributed to several mechanisms. Omega-3 fatty acids particularly EPA and DHA, have been associated with enhanced insulin sensitivity, reduced insulin resistance and decreased chronic low-grade inflammation[14]. These mechanisms are integral to the pathophysiology of diabetes and its complications. Interestingly our study found that adherence to the Omega-3 rich diet was associated with a more significant reduction in HbA1c levels. This highlights the importance of dietary compliance in realizing the potential glycemic benefits of Omega-3 fatty acids a finding supported by a study conducted by Montori *et al*.[15]. However, it is essential to acknowledge certain limitations of this study. Firstly the observational design limits our ability to establish causation and residual confounding factors may influence the results. Secondly dietary adherence relied on self-reporting introducing potential reporting bias. Lastly the relatively small sample size may limit the generalizability of the findings.

CONCLUSION

This study indicates that Omega-3 fatty acids in the diet may positively influence blood sugar regulation in people with diabetes mellitus. The observed decreases in HbA1c and fasting blood glucose in the Omega-3 Group underscore the potential of Omega-3 supplements as a complementary treatment for diabetes. Nonetheless more detailed investigations, preferably randomized controlled trials are essential to validate these outcomes and determine the best dosages and length of Omega-3 supplementation for diabetes management.

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