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EFFECT OF OMEGA-3 AND 6 POLYUNSATURATED FATTY ACIDS ON DIABETES MELLITUS TYPE 2.

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ABSTRACT

OBJECTIVES: To evaluate the effects of optimized proportions of Omega-3 and Omega-6 polyunsaturated fatty acids on diabetes mellitus type 2.**METHODOLOGY:** The experimental analytical study was carried out in the research lab of Isra University Hospital Hyderabad from March to August 2022. A total 50 male healthy albino Wistar rats weighing about 200 ~ 250 grams were procured from the animal house of Sindh Agricultural University Tandojam. After completion of the acclimatization period, rats were initially divided into group A and B Control n=10 and Experimental groups n=40 respectively. The control group received a standard chow diet and water ad libitum for one month. The experimental group rats were injected with Alloxan 150mg/kg body weight mixed with 2ml normal saline intra-peritoneally to induce diabetes in the experimental groups. After induction experimental rats were further divided into 4 groups n=10. Group B1 Diabetic control group after inducing diabetes fed with a normal chow diet ad labitum for 30 days. Group B2 Experimental Omega-3 Treated Group was fed a diet mixed with 0.3gms/kg b.w of Omega-3 fatty acid for 30 days.Group B3 Experimental Omega-6 Treated Group fed diet mixed with 0.3gms/kg b.w of Omega-6 fatty acid for 30 days. Group B4 Experimental Combination Treated Groups was fed a diet mixed with equal amounts of Omega-3 and Omega-6 fatty acids in a dose of 0.3gms/kg b.w for 30 days.**RESULT:** A significant difference between the mean body weight of rats of groups A, B1, B2, B3, B4 $p<0.05$. The mean level of FBS before and Mean level of FBS after induction showed statistically significant at p-values <0.05 and <0.001 respectively. The mean level of C-reactive proteinmg/L in Control was 0.11±0.03 while in group B1 rats was 0.61±0.12 in B2 rats was 0.24±0.04, in B3 rats was 0.31±0.08 and in B4 rats was 0.17±0.03. The C reactive levels were found to be significantly elevated in group B1 compared with A, B2, B3, and B4 rats. **CONCLUSION:** It is concluded from the present study that the administration of equal proportions of Omega-3 and Omega-6 polyunsaturated fatty acids plays a significant role in regulating body homeostasis and also impacts glycemic control by improving markers of insulin resistance.**KEYWORDS:** Omega-3, 6, PUFA polyunsaturated fatty acids, insulin markers, Alloxan, Albino rats.

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How To Cite This Article: Jaat I A[1], Shaikh Y[2], Alam A[3], Mujadid G [4], Nida[5], Farooqui F[6]. **EFFECT OF OMEGA-3 AND 6 POLYUNSATURATED FATTY ACIDS ON DIABETES MELLITUS TYPE 2.** JPUMHS;2023:13:03,64-67.http://doi.org/10.46536/jpumhs/2023/13.03.448

Received March 9.2023, Accepted On 15 September 2023, Published On 30 September 2023.

INTRODUCTION

Diabetes is responsible for nearly 6% of global mortality. [1] Cardiovascular disease is responsible for 50% of diabetes-related deaths and is caused by insulin resistance, hyperinsulinemia, and other factors. [2] The global rise in the incidence of diabetes can be due to a sedentary lifestyle which increases obesity and inactivity, which explains why dietary control and active lifestyle play a key role in treating, preventing, and delaying the onset of type 2 diabetes mellitus. Insulin resistance leads to episodes of fasting and postprandial hyperglycemia. It also leads to elevation of fatty acid levels, elevation of insulin levels, and generalized pancreatic β-cell dysfunction.[3] The main reason behind this insulin resistance is a positive energy balance, caused by the consumption of low-nutritional food in excess and a lack of physical activity. [4] Nutraceuticals, which are pharmaceutical pills or capsules containing bioactive ingredients, are the focus of recent emerging research on their effectiveness as active agents for the treatment of metabolic disorders like diabetes.[5] Polyunsaturated fatty acids also play a key role in the treatment as well as prevention of metabolic diseases like diabetes.[6]

Omega-3 and omega-6 Polyunsaturated Fatty acids have conversing effects on metabolic functions in the body.[7] Omega-3 plays an important role in metabolic disorders by preventing their effects on cell membrane structure and regulating transcription factors by modification of gene expression whereas Omega-6 serves as a precursor of pro-inflammatory mediators such as prostaglandins and leukotrienes. [8-10] Considering the opposite effects of both omega−3 and omega−6 Fatty acids, the optimum proportion of these Polyunsaturated Fatty acids plays a key role in regulating body homeostasis. These Polyunsaturated Fatty acids may regulate diverse sets of homeostatic processes.1[1]

Considering these benefits, a balanced and adequate intake of polyunsaturated fatty acids is potentially beneficial for protection against certain chronic and metabolic disorders. The objective of the present study was to evaluate the effects of optimized proportions of Omega-3 and Omega-6 Polyunsaturated Fatty acids and their effects on different markers of insulin resistance in diabetes.

METHODOLOGY

This Experimental study was conducted at the clinical laboratory of Isra University Hospital from March to August 2022 after getting approval from the research and ethics committee of Isra University. A total of 50 healthy male albino Wistar rats of weight between 200 and 250 grams were recruited from the animal house of Sindh Agriculture University, Tando Jam. All the rats were kept in stainless steel cages at room temperature of 30±1ºC and day and night cycle per 12 hours in a well-ventilated environment for acclimatization for 7 days. During that period normal chow with ad labitum and clean water was given to all rats. After completion of the acclimatization period, rats were initially divided into Control n=10 and Experimental groups n=40. The control group received a standard chow diet and water ad libitum for one month. The experimental group rats were injected with Alloxan 150mg/kg body weight mixed with 2ml normal saline intra-peritoneally to induce diabetes in the experimental groups. Rats were fasted 12 hours before and after the induction of diabetes after injection of alloxan as unfed or fasted animals are more susceptible to alloxan-induced diabetes. A blood sample for the measurement of glucose levels was taken from the base of the tail at 72 hrs to ensure the onset of diabetes. The day on which blood glucose level reached >250mg/dl that day was counted as the first day of experimentation. After induction experimental rats were further divided into 4 groups n=10.

- Group B Diabetic control group after inducing diabetes fed with a normal chow diet ad labitum for 30 days.
- Group C Experimental Omega-3 Treated Group was fed a diet mixed with 0.3 gms/kg b.w of Omega-3 fatty acid for 30 days.
- Group D Experimental Omega-6 Treated Group was fed a diet mixed with 0.3 gms/kg b.w of Omega-6 fatty acid for 30 days.
- Group E Experimental Combination Treated Groups was fed a diet mixed with equal amounts of Omega-3 and Omega-6 fatty acids in a dose of 0.3 grams/kg b.w for 30 days.

After sacrificing the rats by cervical dislocation, blood samples were collected into gel tubes by cardiac puncture. After centrifuging the tubes at 5000 rpm for 5 min, the serum was separated which was then used for biochemical analysis. After the separation of serum Fasting blood is processed in Electro chemo-luminescence Immunoassay ECLIA immunology Analyzer "ROCHE" company which is a fully automated instrument. Cobas e-411 for measuring levels of Fasting insulin. Serum C-reactive protein CRP levels were determined through the qualitative slide method.

The data obtained was analyzed through SPSS Version 21. ANOVA, Pearson's Correlation, and Student's t-test were applied to determine different parameters. Significance was set at the P-value of ≤ 0.05.

RESULTS

The mean post-experimental body weight of the study animals in all five groups A, B, C, D, and E are presented in Figure 1. There was a significant decline in the body weight of the diabetic group group B. The intervention groups C and D showed a lesser decline in body weight as compared with group B. However, the best results were observed in the combination therapy group group E.

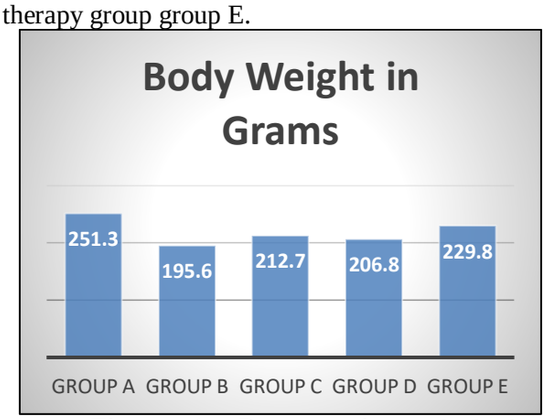

Figure 1: Post-experimental body weight of study animals in different groups

The distribution of the mean levels of C-reactive proteins in different groups is presented in Table I below. The CRP levels were found to be significantly raised in group B. While groups C and D also showed a rise in the mean CRP levels, the rise was not as pronounced as compared with group B. However, the best results were observed in group E which showed the least rise in mean CRP levels. Table I

Table I – Mean C-reactive protein levels in different groups mg/dL

Table II shows the distribution of the mean levels of serum Insulin in different groups. The insulin levels were found to be significantly lowered in group B. While groups C and D also showed a decline in the mean CRP levels, the fall was not as pronounced as compared with group B. However, the best results were observed in group E which showed the least decline in mean CRP levels. Table II

Table II– Mean serum Insulin levels in different groups mg/dL

Groups	Mean	SD ±	P-Value
Group A	2.19	0.64	0.001
Group B	0.66	0.59	
Group C	0.97	0.68	
Group D	1.19	0.93	
Group E	1.88	0.77	

DISCUSSION

Insulin plays a critical role in achieving euglycemic states. However, even in the presence of normal insulin levels, sometimes the cells become unresponsive to insulin and give rise to a condition known as insulin resistance.12 Urbanization carries with it many factors that run hand in hand with the occurrence and worsening of diabetes. These include a sedentary lifestyle, overeating, overindulgence in junk food, and a positive family history.

In Pakistan, the incidence of diabetes is comparatively higher in urban areas than in rural areas.13 Moreover, this higher insulin resistance in people living in urban areas is possibly due to the factors mentioned above.

In our study, we found that treatment with alloxan caused a decline in the diabetic group. This decline in body weight, however, was less pronounced in the intervention groups receiving Omega 3 and Omega 6 with the best results being observed in the combination therapy group. These results were consistent with the findings of Atallah et al. who also observed the effects of Omega-3 and Omega-6 supplementation on glycemic control.14

In the current study, the mean CRP levels were found to be significantly raised in group B. While omega 3 and Omega 6 intervention groups resisted this rise in serum CRP levels with the best results being observed in the combination therapy group. These results were consistent with the findings of Khalili et al. and Natto et al who investigated the role of inflammation in the association of insulin sensitivity and resting metabolic rate.15, 16

Although the current study was able to find the beneficial effects of the combination therapy of these polyunsaturated fatty acids, the study was not free from certain limitations. The current study had certain time and monetary restraints due to which other related as well as relevant variables such as markers of oxidative stress, levels of glycosylated hemoglobin HbA1C, and other markers of inflammation could not be assessed which leaves room for further research on this topic.

Groups	Mean	SD ±	P-Value
Group A	0.13	0.03	0.001
Group B	0.66	0.12	
Group C	0.27	0.04	
Group D	0.33	0.08	
Group E	0.19	0.03	

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

FUNDING: The work was not financially supported by any organization. The entire expense was taken by the authors.

ACKNOWLEDGEMENTS: We are thankful to all who were involved in our study.

AUTHORS' CONTRIBUTIONS: All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared.

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