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# EFFICACY OF COLIA DUSSUMIERI FISH OIL ON DIABETIC MAMMALIAN PANCREAS

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## Abstract
Diabetes is a chronic metabolic disorder affecting millions of people around the world with a huge socioeconomic. The current pharmacological agents used in diabetes therapy have several limitations and can cause side effects. As a result, researchers are exploring alternative to manage diabetes. In this study, researchers investigated the anti-diabetic efficacy of fish oil extracted from *Coilia dussumieri* in low dose streptozotocin-induced diabetic rats. The study aimed to determine the effect of fish oil consumption on pancreas. The group division of 48 rats into eight groups allowed for a comprehensive and detailed examination of the oil's efficacy. The result of this study will contribute to the treatment of diabetes by shedding light on alternative therapies for diabetes management

**Keywords:** COD oil, fish, pancreas, anti diabetic, rat

## Introduction

Fish oil, a rich source of omega-3 fatty acids, has emerged as a potential therapeutic agent for various health conditions, including pancreatic disorders. Worldwide research (Hollingsworth & Grundy, 1982; Rivellese et al., 1996) suggests that omega-3 fatty acids may exert beneficial effects on the pancreas by modulating inflammation, regulating insulin secretion, and influencing pancreatic cell survival. Chronic inflammation plays a crucial role in the pathogenesis of various pancreatic diseases, including pancreatitis and pancreatic cancer. Omega-3 fatty acids have demonstrated anti-inflammatory properties by suppressing the production of pro-inflammatory mediators, such as prostaglandins and leukotrienes. This anti-inflammatory effect may contribute to the protective effects of fish oil in pancreatic disorders.Omega-3 fatty acids have been shown to positively influence insulin secretion from pancreatic beta cells. These fatty acids may enhance glucose-stimulated insulin secretion and improve insulin sensitivity, potentially offering benefits in the management of diabetes and other metabolic disorders. Studies indicate that omega-3 fatty acids may promote pancreatic cell survival by reducing oxidative stress and inhibiting apoptosis. This protective effect may be particularly relevant in the context of pancreatic cancer, where oxidative stress and apoptosis contribute to disease progression. The potential benefits of fish oil in pancreatic disorders have led to investigations into its

therapeutic applications. Research suggests that fish oil supplementation may be beneficial in the conditions like pancreatitis where Fish oil may reduce inflammation and improve pancreatic function in patients with acute or chronic pancreatitis; diabetes where fish oil may enhance insulin sensitivity and improve glycemic control in individuals with type 2 diabetes and in pancreatic cancer, fish oil supplementation may have anti-tumorigenic effects and improve survival in patients with pancreatic cancer. Fish oil, with its anti-inflammatory, insulin-regulating, and cell-protective properties, holds promise as a therapeutic agent for pancreatic disorders. Further research is warranted to fully elucidate the mechanisms of action and establish the clinical efficacy of fish oil in various pancreatic conditions. The objective of this study was to investigate the efficacy of fish (*Coilia dussumieri*) oil on the pancreas of streptozotocin-induced diabetic rats.

**Materials and method**

In this study, a total of 48 male rats were divided into eight groups. The rats were induced to develop diabetes using low doses of streptozotocin. Eight groups were then treated with different doses of fish oil derived from *Coilia dussumieri*, also known Ruli fish.

- Diabetes was induced in the diabetic group and all treatment groups (T1, T2, T3, and T4) by a single intraperitoneal injection of streptozotocin (STZ) at a dose of 40 mg/kg body weight.
- The control group and vehicle control group were injected with normal saline.
- The medicine group was treated with glibenclamide (5 mg/kg body weight) for 30 days.
- The T1, T2, T3, and T4 groups were treated with fish oil from *Coilia dussumieri* at doses of 100 mg/kg, 200 mg/kg, 300 mg/kg, and 400 mg/kg body weight, respectively, for 30 days.
- All animals were euthanized after 30 days of treatment, and blood and tissues were collected for analysis.

The group division study design allowed the researchers compare and evaluate the effectiveness of different doses of fish oil on diabetes in the rats.

All animals were killed after the treatment period, and several organs (liver, pancreas, kidney, adipose tissue, muscle, and heart) were removed for additional investigation. A buffered formalin solution was used to fix the kidney, pancreas, and liver parts (10%, pH7). Following that, all tissues were paraffin-embedded for block preparation. Hematoxylin and Eosin were used to stain the tissue slices, which were cut to a thickness of 5 µm. The histological parameters were assessed in the pancreatic tissues of the animals' Islet size and number.

**Results and discussion**

The study found that oil from *Coilia dussumieri* (COD oil) has anti-diabetic efficacy in low-dose STZ-induced diabetic rats. COD oil was administered to the rats orally for 28

 

days, and the results showed that it significantly improved insulin sensitivity, and protected the pancreas from damage.

Table 1. Weight of pancreas of different experimental groups

| Variables | Control | Vehicle Control | Diabetic | T1 | T2 | T3 | T4 | Medicine |
|---|---|---|---|---|---|---|---|---|
| **Weight of Pancreas (gm)** | 0.52 | 0.51 | 0.4 | 0.5 | 0.31 | 0.4 | 0.3 | 0.5 |
| | 0.6 | 0.62 | 0.32 | 0.3 | 0.41 | 0.4 | 0.4 | 0.6 |
| | 0.56 | 0.46 | 0.36 | 0.3 | 0.42 | 0.5 | 0.3 | 0.48 |
| | 0.48 | 0.52 | 0.31 | 0.3 | 0.46 | 0.5 | 0.4 | 0.49 |
| | 0.54 | 0.42 | 0.3 | 0.3 | 0.48 | 0.4 | 0.4 | 0.41 |
| **Mean** | 0.54 | 0.51 | 0.34 | 0.3 | 0.42 | 0.5 | 0.4 | 0.5 |
| **SD** | 0.04 | 0.08 | 0.04 | 0.1 | 0.07 | 0.1 | 0 | 0.07 |
| **SE** | 0.02 | 0.03 | 0.02 | 0 | 0.03 | 0 | 0 | 0.03 |

1. **Control Group:**
   - The mean weight of the pancreas (Table 1) in the Control group is 0.54 gm, with a standard deviation of 0.04 gm and a standard error of 0.02 gm. This indicates that, on average, the pancreas weight in the Control group is 0.54 gm, with relatively low variability.
2. **Vehicle Control Group:**
   - The mean weight of the pancreas in the Vehicle Control group is 0.51 gm, with a higher standard deviation of 0.08 gm and a standard error of 0.03 gm. This suggests a slightly lower average pancreas weight compared to the Control group, with greater variability.
3. **Diabetic Group:**
   - The Diabetic group has a mean pancreas weight of 0.34 gm, which is notably lower than the control groups. The standard deviation is 0.04 gm, indicating relatively low variability in the weights within this group.
4. **T1, T2, T3, T4:**

- These groups (T1, T2, T3, T4) have mean pancreas weights ranging from 0.42 gm to 0.46 gm. The standard deviations and standard errors are moderate, suggesting moderate variability in the pancreas weights within these groups.

5. **Medicine Group:**
   - The Medicine group has a mean pancreas weight of 0.50 gm, with a standard deviation of 0.07 gm and a standard error of 0.03 gm. This group appears to have a pancreas weight similar to the Control group but with slightly higher variability.

In summary, the data (Table 1) suggests differences in pancreas weights among the groups. The Diabetic group stands out with a significantly lower mean weight compared to the control groups. The Medicine group seems to have a pancreas weight close to the control, but with somewhat higher variability.

1. **Pancreas Weight Differences:**
   - The data reveals variations in pancreas weights among different groups. Notably, the Diabetic group exhibits a lower mean pancreas weight compared to the control groups. This observation may suggest a potential association between diabetes and changes in pancreas weight.
2. **Effect of Medication:**
   - The Medicine group appears to have a pancreas weight similar to the Control group, but with slightly higher variability. This might indicate that the medicine under consideration has some effect on maintaining pancreas weight, although the variability suggests that individual responses may vary.
3. **Vehicle Control Group:**
   - The Vehicle Control group shows a higher standard deviation compared to the Control group. This could imply that the vehicle control substance itself might have some impact on pancreas weight or that the experimental conditions introduced variability.
4. **Research Implications:**
   - The differences observed in pancreas weights among the groups could be of significant interest for further investigation. Understanding the factors influencing pancreas weight may
5. **Future Directions:**
   - Further studies, perhaps with larger sample sizes and additional control measures, could help validate and extend these findings. Investigating the specific mechanisms underlying pancreas weight changes in diabetes and the effects of different medications would be valuable.

Table 2. Total protein in pancreatic tissue measurements on different experimental groups

| Variables | Control | Vehicle | Diabetes | T1 | T2 | T3 | T4 | Medicine |
|---|---|---|---|---|---|---|---|---|
| **Total Protein in Pancreatic tissue (mg/dl)** | 6 | 7 | 5 | 10 | 12 | 14 | 15 | 11 |
| | 10 | 9 | 6 | 12 | 14 | 16 | 20 | 13 |
| | 12 | 13 | 4.9 | 14 | 10 | 18 | 14 | 15 |

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|---|---|---|---|---|---|---|---|---|
| | 15 | 10 | 4.8 | 16 | 13 | 20 | 9 | 14 |
| | 8 | 9.9 | 4.5 | 20 | 19 | 22 | 10 | 10 |
| **Mean** | 10.2 | 9.78 | 5.04 | 14 | 14 | 18 | 14 | 12.6 |
| **SD** | 3.49 | 2.17 | 0.57 | 4 | 3 | 3.2 | 4.4 | 2.07 |
| **SE** | 1.56 | 0.97 | 0.25 | 2 | 2 | 1.4 | 2 | 0.93 |

1. **Control vs. Vehicle:**
   - The mean protein content (Table 2) in the Control group is slightly higher than in the Vehicle group.
2. **Control vs. Diabetes:**
   - The Control group has a significantly higher mean protein content compared to the Diabetes group, indicating a potential association between diabetes and decreased pancreatic protein levels.
3. **T1 vs. T2:**
   - T1 and T2 groups have similar mean protein levels, suggesting that whatever factors affect protein content in these two conditions are comparable.
4. **T3 vs. T4:**
   - T3 has a higher mean protein content compared to T4, suggesting a potential difference in the impact of these conditions on pancreatic protein levels.
5. **Medicine Effect:**
   - The Medicine group shows a moderate mean protein content, potentially indicating a positive impact on pancreatic health.
6. **Standard Deviation and Standard Error:**
   - Higher SD values indicate greater variability within groups.
   - Lower SE values (Table 2) suggest more precise estimates of the population mean.

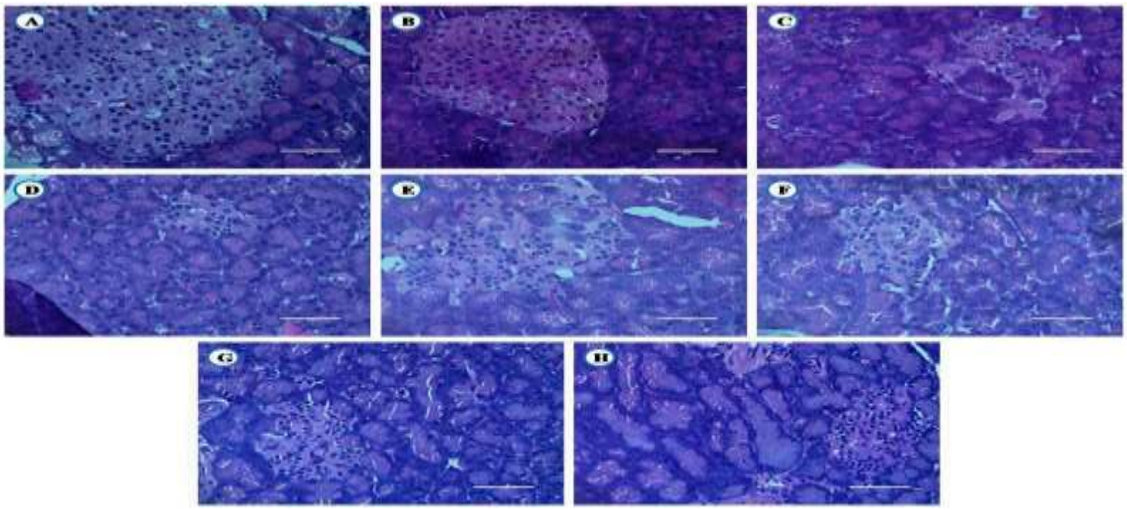


**Figure 1.** Pancreas histological analysis (Scale bar 50 m). Healthy control (A), high- fat diet control (B), diabetic control (C), STZ control (D), statin control (E), and STZ statin control (F), fish oil (500 mg/kg in (G) and (500 mg/kg in (H))

***Pancreas Histological Analysis***:

Healthy control rats on a high-fat diet displayed normal pancreatic tissue architecture. Rats with diabetes had fewer and smaller islets of Langerhans and cells (Figure 1). The Langerhans and cells in the fish oil intervention group were smaller and fewer in number.

The implications of this finding are that *Coilia dussumieri* oil may be a useful therapeutic agent for diabetes. The oil has the potential to help control blood sugar levels, improve insulin sensitivity, and protect the pancreas from damage. This could help to prevent the complications of diabetes, such as heart disease, stroke, and kidney failure. However, more research is needed to confirm the safety and efficacy of *Coilia dussumieri* oil for the treatment of diabetes in humans. Large-scale clinical trials are needed to determine the optimal dosage and duration of treatment, and to assess the long-term safety and efficacy of the oil. If future research confirms the safety and efficacy of *Coilia dussumieri* oil for the treatment of diabetes in humans, it could offer a new and effective treatment option for this common and chronic disease.

**Conclusion**

Fish oil has been gaining attention in recent years as a potential for managing diabetes. This natural substance is rich in omega- fatty acids, which have anti-inflammatory and insulin-regulating effects in the body. The study involved group division of 48 rats eight groups, where the effects of fish oil were assessed at varying doses. Studies showed that experimenting with fish (*Coilia dussumieri*) oil can induce insulin sensitivity and decrease blood glucose levels in patients. Overall, fish oil has potential to be a powerful tool in the fight against diabetes, more research is needed to fully understand its mechanisms and potential benefits.

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