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Original Article

The association between seafood consumption and non-seafood consumption with serum levels of non-HDL cholesterol

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Abstract

Greater consumption of seafood is linked with a decreased risk of coronary artery disease (CAD). We proposed that elevated seafood consumption could correlate with lower non-high-density lipoprotein cholesterol (non-HDL C), encompassing various dyslipidemia aspects, along with a healthful lifestyle. To find the association between seafood consumption and non-seafood consumption with serum levels of non-HDL cholesterol. A cross-sectional study took place at the Chettinad Hospital and Research Institute's biochemistry department in Kelambakkam, India, spanning from July 2023 to December 2023, 100 subjects who visited the hospital's blood sample collecting area were chosen. Individuals suffering from chronic disorders like cancer, coronary artery disease, cardiovascular disease, renal failure, pregnant and lactating women, alcohol and cigarettes consumers as well as people consuming omega-3 supplements were excluded from the study. Subjects who were willing to give consent between 20 to 60 years of both genders were incorporated into the study. Subjects experienced clinical examinations, and a thorough history and anthropometric measurements were looked at and documented. The participants were categorized according to their seafood consumption. The study involved 100 participants, divided equally into 50 seafood consumers and 50 non-seafood consumers. It was observed that the subjects with the greatest intake of seafood had linked with lower levels of non-HDL-C blood in Pearson's CorrelationCorrelation and demonstrated statistical significance ($p \leq 0.001$) using an Independent T-test. The study results indicate that consuming seafood at a high frequency per week was found to be linked with lower non-HDL-C levels and a diminished risk of coronary artery disease (CAD) in individuals aged 20 to 60 years from Kelambakkam.

Keywords: seafood consumption, non-HDL-C, coronary artery disease, non-seafood consumption

Introduction

Cardiovascular disease is a primary factor of morbidity and mortality worldwide. "The WHO estimates that 17.9 million individuals worldwide pass away from cardiovascular disease (CVD) each year" [1]. In India, the incidence of cardiovascular disease has notably increased over the past two decades, constituting 24% of all adult deaths in the 25–69 age group [2]. The presence of dyslipidemia is essential for the progression of atherosclerotic cardiovascular disease (ACVD). "The World Health Organisation estimates that dyslipidemia is associated with more than 50% of global cases of ischemic heart disease and over 4 million deaths per year. About 80% of lipid disorders are related to diet and lifestyle" [3]. Diet significantly influences our physical well-being and metabolism. Essential roles in cellular functions, including signaling, preserving cell membrane fluidity, and ensuring structural integrity, are played by omega-3 polyunsaturated fatty acids (n-3 PUFA) found in fish oil.

Additionally, they modulate inflammatory mechanisms associated with cardiovascular disease (CVD) development. Epidemiological research indicates that

consuming n-3 PUFA offers protection against heart-related issues [4, 5]. Fish oils and various seafood are rich sources of n-3 polyunsaturated fatty acids (n-3 PUFAs), specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which exhibit significant cardioprotective effects.

Non-HDL cholesterol is one of the easiest markers to use instead of the calculated LDL values. Several study results have shown that evaluating cardiovascular risk is more effectively done using non-HDL cholesterol than LDL cholesterol [6–9]. The elevation in non-HDL-C levels indicates the comprehensive metabolic irregularities in LDL, HDL, and TG, establishing it as an acknowledged risk factor for atherosclerotic cardiovascular disease (ASCVD). Hence, we postulated that consuming seafood containing n-3 PUFA would be associated with serum lipid levels [10, 11].

Seafood consumers consume organisms like fish, shrimp, oysters, dry fish etc. Those who refuse to eat seafood or who have stopped doing so for more than five years are considered non-seafood consumers. Non-seafood consumers may choose to avoid seafood due to personal preferences, dietary restrictions, or ethical concerns regarding the fishing industry's impact on marine ecosystems. Additionally, some individuals may have developed allergies or sensitivities to certain types of seafood, further influencing their decision to abstain from consuming it.

This cross-sectional study aimed to explore the relationship between the weekly average frequency (measured in days) of seafood consumption and the evaluation of serum non-HDL-C levels. The analysis included individuals who had not undergone any lipid-modifying therapy, considering both those who consumed seafood and those who did not.

Material and methods

A cross-sectional investigation was conducted on the subjects. On those who consume sea and non-sea foods and take lipid profiles at Chettinad Hospital and Research Institute, Kelambakkam. The present research was carried out after obtaining approval from the institutional ethics committee. An average of 100 participants were involved, comprising 50 adults aged 20–60 who consumed seafood and 50 who did not. Participants were grouped into seafood and non-seafood consumers to correlate and compare the serum levels of non-HDL cholesterol. Inclusion criteria: Females between 20 and 60 years of age who were willing to consent were included in the study. Non-alcoholic,

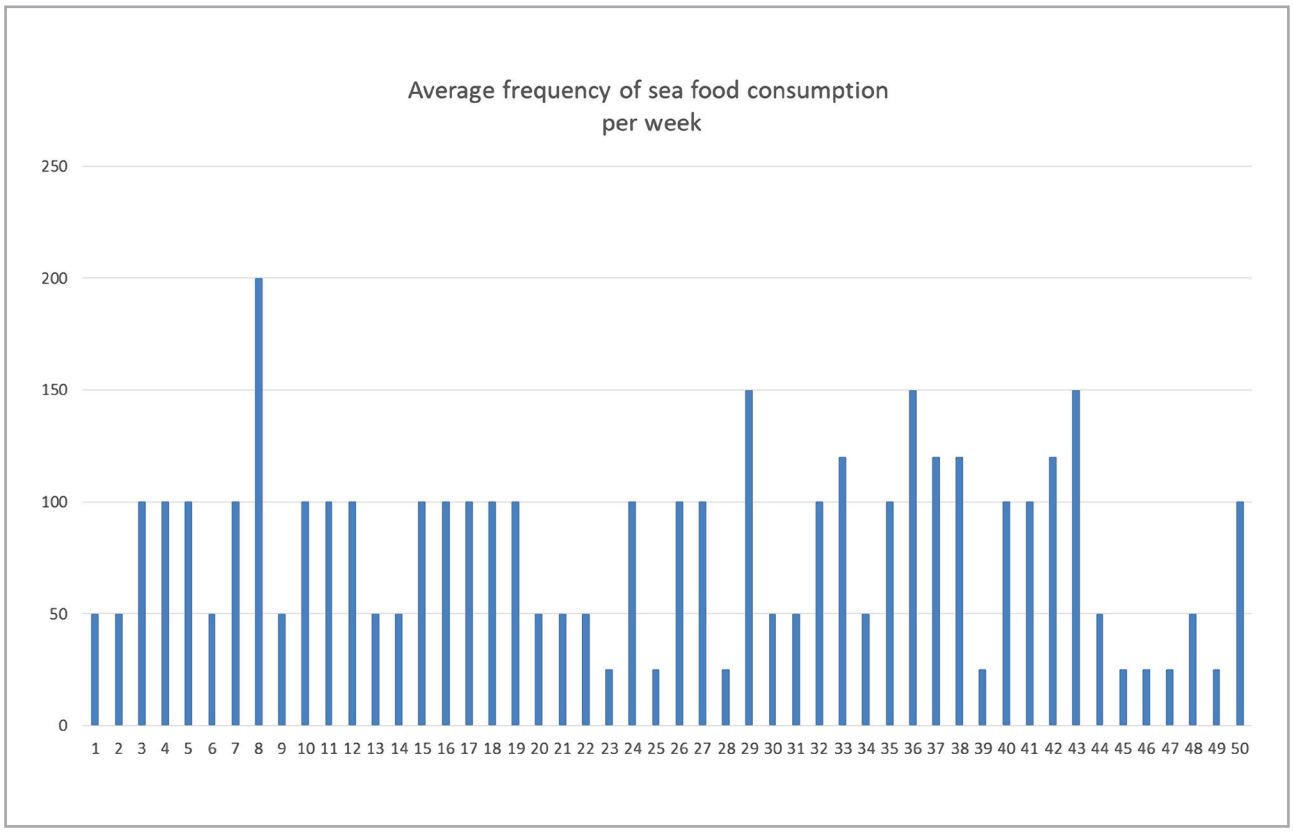

Figure 1: Frequency of daily seafood consumption per week.

non-smoking, and not taking any omega-3 supplements are included. Exclusion criteria: Individuals suffering from chronic disorders like cancer, coronary artery disease, cardiovascular disease, renal failure, pregnant and lactating women, and alcohol and cigarettes consumers. People consuming omega-3 supplements were excluded from the research.

Laboratory, anthropometric and clinical data collection

Demographic and nutritional information were collected using a standardized questionnaire. The frequency of seafood consumption is obtained based on the food frequency questionnaire. Anthropometric measurements like height and weight were measured through standard procedure, and BMI was computed by dividing weight in kilograms by the square of height in meters. 5ml blood was taken in a red-topped vacutainer, and serum was separated according to the conventional method. Following the blood sample collection, the clinical biochemistry lab at Chettinad Hospital And Research Institute (CHRI) utilized Siemens Dimensions RxL to estimate serum total cholesterol (TC), triglycerides (TG), and High-Density Lipoprotein-Cholesterol (HDL-C). LDL and VLDL were determined using Friedwald's Formula, while non-HDL-C was computed by subtracting HDL levels from Total Cholesterol levels.

Statistical analysis

For continuous variables, the data were expressed as means with standard deviation. The significance between the groups was assessed using the t-test. Significance was considered only at $p<0.001$. Pearson's CorrelationCorrelation was used to determine the relationship between seafood consumption rate and serum non-HDL cholesterol levels. IBM SPSS (Statistical Package for Social Services) version 29 was used to evaluate the collected data from the study subjects.

Results

Subjects: The average frequency of seafood intake was 80±40.5 intervals a week. The blood non-HDL-C level ranged from 48 to 245 mg/mL (mean±SD: 145±37 mg/dL). Figure 1 and Figure 2 depict the frequency of seafood intake, and Table 1 shows demographic traits.

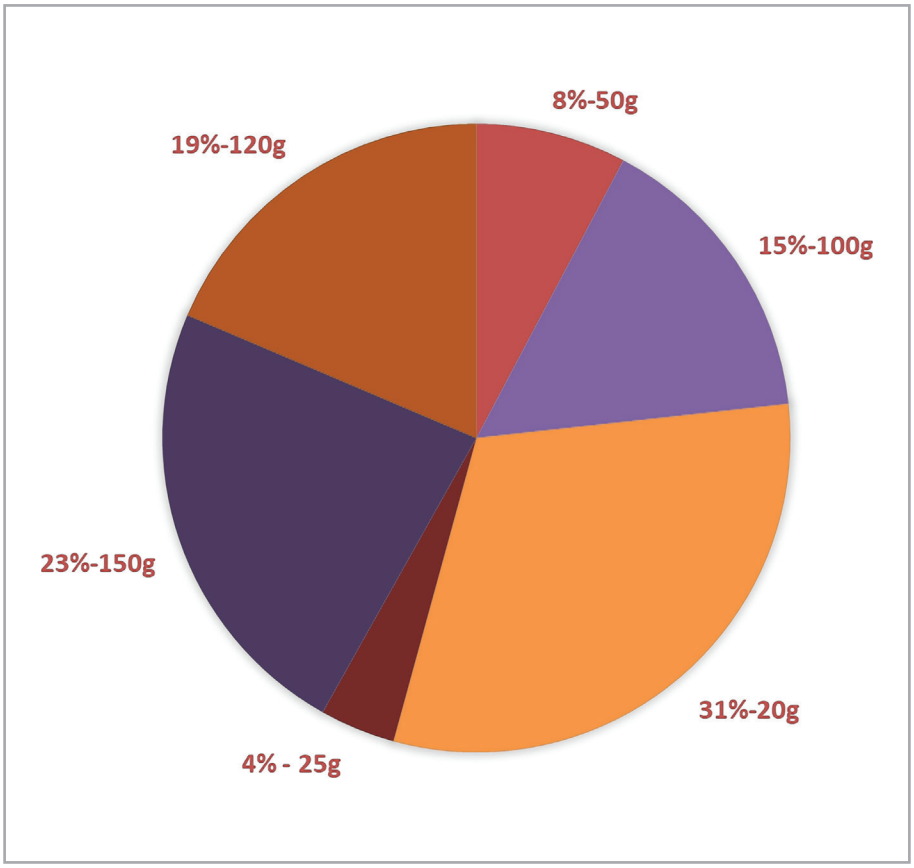

Figure 2: Average seafood consumption per week.

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Table 1: Descriptive statistics of study participants.

Variables	All cases (n=100)	
	Male (n=50)	Female (n=50)
Age	49.77±11.4 (20–59 years)	
BMI (kg/m²)	25.97±3.69 (20–33 kg/m²)	
HDL-C (mg/dL)	41±8.98	
LDL-C (mg/dL)	120.56±37.2	
TG (mg/dL)	186.7±38	
Non-HDL-C (mg/dL)	145±37.92	

Note: BMI – body mass index; HDL-C – high-density lipoprotein cholesterol; LDL-C – low-density lipoprotein cholesterol; TG – triglyceride; Non-HDL-C – non-high-density lipoprotein Cholesterol.

Comparison of serum non-HDL-C level and frequency of seafood intake per week in seafood consumers

The subjects' non-HDL cholesterol levels were assessed based on their weekly seafood consumption, which was treated as a categorical variable (0–50 g, 60–100 g, 110–150 g, 160–200 g). A weekly increase in seafood consumption is associated with a decrease in non-HDL cholesterol levels (Figure 3).

Table 2 shows the correlation analysis with lipid parameters and weekly seafood consumption.

Table 3 implies that the independent sample T-test was utilized to detect the statistical variance in lipid parameters among seafood and non–sefood consumers.

Discussion

This cross-sectional study revealed that higher weekly fish consumption was linked to a notable reduction in serum non-HDL cholesterol levels. As a result, an increased weekly intake of fish was associated with a positive enhancement in the lipid profile.

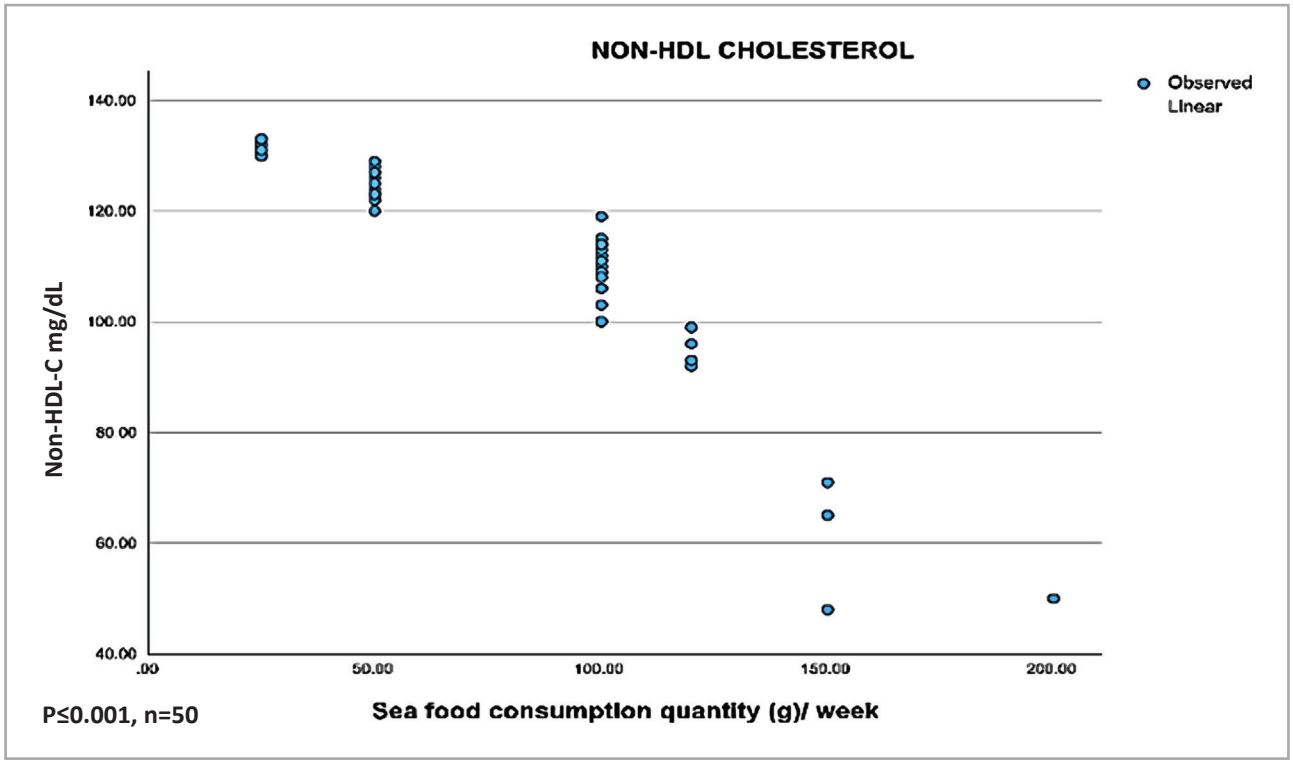

Figure 3: The non-HDL-C level and weekly seafood intake frequency. Non-HDL-C – non-high-density lipoprotein cholesterol.

Table 2: Correlation analysis between non-HDL-C and seafood consumption quantity per week.

Variables	Seafood consumption	
	R-value	P-value
Non-HDL-C	-9.11	<0.001
BMI	-0.468	<0.001
LDL	-0.035	0.807
TGL	-0.16	0.252
HDL	0.156	0.279

Note: The data was given as an analysis of CorrelationCorrelation between Lipid parameters and weekly seafood intake quantity in seafood consumers by utilizing IBM SPSS (statistical packaging social services) version 29.0, and Correlation is statistically significant at 0.005 level.

Table 1 displays the descriptive statistics for the study's 100 participants (50 seafood consumers and 50 non-seafood consumers).

Table 2 shows the correlation analysis with lipid parameters and seafood consumption per week. The CorrelationCorrelation between the Non-HDL-Cholesterol and seafood consumption per week was strongly significant. The correlation between BMI and seafood consumption was significant. Tani S. *et al.*'s study indicates that frequent fish intake, specifically six to seven days a week, is linked to a healthy way of living and lower non-HDL cholesterol levels. This finding suggests that increased seafood consumption contributes to healthy living and reduced occurrence of coronary artery disease in Japanese men aged 50 and above, with statistically significant results [12]. Jacobson T.A *et al.* and Tani S *et al.* also prove the same [13, 14]. Park *et al.*'s research reveals a correlation between limited seafood intake and lower baseline consumption of EPA and DHA. This underscores the significance of seafood as a crucial source of these essential fatty acids. Participants with low seafood intake experienced a higher cumulative cardiovascular disease (CVD) incidence. Notably, after a 10-year follow-up, individuals with high seafood intake exhibited a lower hazard ratio (HR) for CVD. In summary, the study suggests that enhancing seafood consumption in adults might play a crucial role in reducing the hazard of cardiovascular disease [15]. The correlation analysis between LDL-C, triglycerides-C and seafood consumption was not significant.

Table 3 implies that the independent sample T-test was utilized to detect the statistical variance in lipid parameters among seafood and non–sefood consumers. The Non-HDL-Cholesterol was a statistically significant difference between seafood and non-seafood consumers, with $p<0.001$. The LDL-C and total cholesterol were also shown significant differences with $p<0.00001$, respectively. The Study shows that LDL-C levels decreased as the frequency of seafood consumption per week rose significantly.

The Triglycerides also exhibited statistical significance at $p<0.05$. The research demonstrates that consuming EPA and DHA effectively reduces serum triglyceride levels, yet these compounds show limited impact

Table 3: Independent sample T-test to determine statistical differences between seafood and non-seafood consumers.

Study parameter	Seafood consumers (Mean±SD)	Non-Seafood consumers (Mean±SD)	P-value
Non-HDL-Cholesterol	112±19.62	169.32±30.24	<0.001
LDL-C	93±24.73	148±25.82	<0.00001
TGL	114.4±55.67	136.24±71.26	<0.05
HDL-C	39.8±9.55	41.98±9.52	0.1778
Total Cholesterol	157±26.07	222.58±18.57	<0.00001

Note: The data was expressed as mean values accompanied by standard deviation (SD). Statistical significance was determined through an independent t-test using IBM SPSS software, version 29.0, with a significance level set at $p<0.005$.

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on lowering serum LDL cholesterol levels. Some findings even suggest that DHA intake may elevate serum LDL cholesterol levels, as proven by the study [16].

The HDL-C was not a statistically significant difference in seafood and non-seafood consumers with a p-value of 0.1778, respectively. The study suggests that frequent consumption of seafood in one's diet and lifestyle adjustments can decrease the incidence of coronary artery disease within a community. While the impact of consuming seafood on reducing coronary artery disease is often linked to the cardiovascular benefits of EPA and DHA found in marine foods, it's crucial to consider the potential influence of other positive lifestyle habits associated with a fish-rich diet.

The study did not provide information about Omega-3 polyunsaturated fatty acid (PUFA) levels in the serum. If these levels had been measured, the study's findings could have been evaluated in greater detail. The study was done with only 100 samples, so a larger sample size would have given greater accuracy of the results.

Conclusion

The findings suggest that eating seafood at a high frequency per week (g/week) was linked with low serum non-hdl-cholesterol levels according to a statistical study and reduces the occurrence of coronary artery disease (CAD) in Kelambakkam individuals aged 20 to 60 years who have not undergone any lipid-modifying therapy.

Acknowledgment

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Conflict of interest

The authors declare no conflict of interest.

Ethics approval

The Institutional Human Ethics Committee (IHEC) of Chettinad Hospital and Research Institute granted approval for the research, with approval ID IHEC-I/2076/23.

Consent to participate

Written informed consent was obtained from all the participants.

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