

Relation between Dietary Omega-3 (n-3) and Omega-6 (n-3) Fatty Acid Intake and Depressive Symptoms in College Students of Central Mindanao University

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Abstract

This study aimed to determine the relationship between the intake of n-3 and n-6 fatty acids and the incidence of depression in college students. This study especially tested whether the association between the two was strong enough to be significant despite the effects of confounders found in college environment. A cross-sectional questionnaire survey was conducted to collect the different data from 201 college respondents for this study. Usual food intake recall (UFIR) was used to determine the n-3 and n-6 fatty acid intake; Beck Depression Inventory – II (BDI-II) for the ascertainment of depressive symptoms and a miscellaneous questionnaire for the determination of confounders. The study used the binary hierarchical logistic regression analysis to analyze the data. The results showed that there was significant relationship between n-3 and n-6 fatty acid intake and depressive symptoms in college students ($\chi^2 = 12.39$, $df = 1$, $p < .000$). The n-3 and n-6 fatty acid intake variable strongly predicted the incidence of depressive symptoms in the hierarchical model ($p < 0.001$, $df = 1$) and that the association was independent from the influence of the confounders. The results also showed that a college student with adequate n-3 and n-6 fatty acid intake was 4.509 times more likely to have no depression than a college student with inadequate intake (95% C.I. = 1.857 to 10.949).

Keywords: College Students, Depressive Symptoms, n-3 and n-6 Fatty Acid Intake, Omega-3 (n-3) Fatty Acid, Omega-6 (n-6) Fatty Acid

Introduction

Throughout history, there have been many changes in the human diet patterns, one of which is the increased ratio of n-6 to n-3 fatty acid intake. One study has concluded that human diet in the Paleolithic period consisted of equivalent proportions of n-3 and n-6 acid and has evolved to contain very high amounts of n-6 fatty acids in the present time [1]. Meanwhile, the prevalence of depression has increased worldwide [2]. This observed coexistence of low dietary n-3 or high n-6: n-3 fatty acid ratio intake and increased prevalence of depression serves as the foundation for the conduct of this study.

One of the biological bases for depression is the deficit of certain neurotransmitters [3]. Serotonin is known to be synthesized in the body as the 'happy hormone' and one of its metabolites is the 5-hydroxyindolacetic acid (5-HIAA). One study found out that low plasma concentrations of polyunsaturated fatty acids, especially docosahexaenoic acid (DHA), which is also an n-3 fatty acid, predicted low concentrations of 5-HIAA in the cerebrospinal fluid among healthy and alcoholic subjects [4]. Recent studies of depressed patients have reported depletion of cell membrane n-3 polyunsaturated fatty acids [5]. The fact that essential fatty acids, which are only obtained from diet, comprise 15-30% of the brain's dry weight adds up to their importance in optimal nervous system function. This led to the hypothesis indicating a possible connection

between dietary n-3 and n-6 fatty acid intake and depression.

This hypothesis has been tested by several studies. One study involving correlations between prevalence of depression and fish consumption in different nations was conducted [6]. The study concluded that there was a potentially substantial interaction between annual prevalence rates of depression and fish consumption. In Finland, two cross-sectional studies revealed a relatively powerful association between fish consumption and depressive symptoms [7, 8]. Fish contains high concentrations of n-3 polyunsaturated fatty acids, in particular DHA. However, there has been no related study which used the Filipino diet as one of the variables or that was conducted in the Philippines. Furthermore, there has been no related study to have determined the association between dietary n-3 and n-6 fatty acid intake and depressive symptoms in college students.

The aforementioned studies only used the fish consumption variable and did not consider the impact of other fatty acids, i.e., n-3 fatty acids, in the whole food intake, which undermines the need to have a balanced n-3/n-6 fatty acid intake. It is important because the amount of dietary n-6 fatty acids can ultimately affect the amount and function of n-3 fatty acids in the body, therefore an optimal n-3/n-6 ratio is needed in order to fully realize the function of these fatty acids in the body, especially in the maintenance of mental health [9]. Furthermore, there are other food sources of n-3 fatty acids and it does not really mean that a high fish diet is a diet proportional n-3/n-6 ratio content. These findings led the researcher to conduct a similar study but in a sample of college students to determine the

strength of association between dietary n-3 and n-6 fatty acid intake and depressive symptoms in line with the other conditioning stress factors in the life of a college student.

Materials and Methods

Research Design and Location

This research was in the form of cross-sectional survey. The research was carried out in Central Mindanao University, Musuan, Maramag, Bukidnon, Philippines. The respondents (college students) were visited for data collection through answering the given questionnaires.

Sampling

A sample of 201 college respondents was selected through proportional allocation stratified random sampling and the use of the Slovin's formula ($e=93\%$). The sample consisted of 80 male and 121 female college students, totaling 201 respondents. The ages of the respondents were above 15 years old.

Data Collection

The respondents were given 3 kinds of questionnaires that answered the data needed for this study. Usual Food Intake Recall (UFIR) sheets were provided to determine the usual diet of the respondents. Beck Depression Inventory – II (BDI – II) questionnaires were rendered to ascertain the level of depressive symptoms of the respondents and short miscellaneous questionnaires for the confounding variables.

Data Processing and Statistical Analyses

The estimations of n-3 and n-6 fatty acid intake of the respondents were then determined using the USDA's National Nutrient Database for Standard Reference at nutritiondata.self.com. Respondents with total n-3 fatty acid intake that supplied not less than 1.3% of the

caloric needs and n-3: n-6 fatty acid ratio intake of not less than 1:4 (0.25) were considered as ones with adequate n-3 and n-6 fatty acid intake [10, 11]. Through the use of BDI – II, the level of depressive symptoms was estimated with the following guidelines: 0 to 13 BDI scores indicate no depression and 14 to 63 scores indicate mild to severe depression.

Hierarchical binary logistic regression analysis, with all the covariates forced into the model before the dietary n-3 and n-6 fatty acid intake variable was entered, was used to estimate the odds ratios (OR) and 95% C.I.'s of all the independent variables in their relationships with the dependent variable (depressive symptoms) in order to ultimately determine the independence or strength of association between depressive symptoms and dietary intake of these fatty acids. All variables in this study were dichotomized. The Hosmer and Lemeshow test was also ran to assess the goodness-of-fit of the data.

Results and Discussions

The total number of college students who became the respondents of this study was two hundred one (201). Thirty eight (38) (18.91%) respondents were aged 20 y/o and they were considered as the old group in this study. One hundred forty one (141) (70.15%) had normal BMI and only fifty seven (57) (28.36%) of them were physically active. Twenty four (24) (11.94%) respondents frequently drink alcohol, four (4) (2%) were frequent smokers, and eighty seven (87) (43.28%) college students frequently drink coffee. One hundred thirty seven (137) (68.16%) students were romantically single; one hundred twenty one (121) (60.20%) respondents said they were academically pressured and finally, seventy eight (78) (38.81%) respondents were far from their homes.

Table 1: Odd ratios of having no depressive symptoms according to selected variables in a hierarchical logistic regression model using data from 201 college students

Variable	Wald Statistic	Odds Ratio ¹	95% C.I.	P<
Older age ²	4.897	2.662	1.118-6.334	.027
Male	2.747	1.784	.900-3.539	.097
Normal BMI ³	.419	1.266	.620-2.587	.517
Far Home Address ⁴	.216	.857	.446-1.646	.642
Frequent Alcohol Intake	1.829	.501	.184-1.364	.176
Frequent Smoking	.472	2.124	.248-18.211	.492
Physically Active ⁵	2.344	1.762	.853-3.639	.126
Single ⁶	.017	1.047	.522-2.101	.896
Academically Pressured	9.922	.320	.157- .650	.002
Frequent Coffee Intake	9.022	.359	.184- .701	.003
Adequate n-3 and n-6 Fatty Acid intake	11.072	4.509	1.857-10.949	.001

¹The odds ratios measure the odds of having no depressive symptoms compared to the direct counterparts of the respective variables

²≥20 years old

³18.5 – 24.99 kg/m²

⁴Outside the Bukidnon province

⁵Having exercise not less than 4 sessions a week

⁶Relationship Status

The average alpha-linolenic acid (ALA) intake of the respondents was 800.84 mg/day, 497.36 mg/day for the average eicosapentaenoic acid (EPA) intake, and 409.72 mg/day for the average docosahexaenoic acid (DHA) intake with total n-3 fatty acid intake of 1,707.92 mg/day.

On the other hand, the average LA intake of the respondents was 10, 579.04 mg/day, and 269.43 mg/day for the average AA intake, with total n-6 fatty acid intake of 10, 848.47 mg/day. The ALA intake was considered inadequate while LA intake was excessive. The n-3/n-6 fatty acid ratio intake of the respondents of 0.1574 was considered inadequate and only thirty nine (39) (19.40%) of them had adequate total n-3 fatty acid intake and at the same time adequate n-3/n-6 fatty acid ratio intake and therefore they were only the ones who were considered to have adequate n-3 and n-6 fatty acid intake in the study.

More respondents with adequate n-3 and n-6 fatty acid intake were also aged ≤ 19 years old, female, normal in BMI, near from home, non-alcohol drinker, non-smoker, not physically active, single, academically pressured, non-coffee drinker, not depressed. The incidence of adequate n-3 and n-6 fatty acid intake with no depressive symptoms (14.43%) was more frequent than adequate n-3 and n-6 fatty acid intake with depressive symptoms (4.98%) by almost four folds. In all categories in each variable, incidence of inadequate n-3 and n-6 fatty acid intake was much more prevalent; it was more common among depressed respondents (46.27%) than among respondents with no depressive symptoms (34.33%).

Ninety eight (98) (48.76%) respondents had no depressive symptoms while the remaining one hundred three (103) (51.24%) respondents had such ones. The incidence of depressive symptoms was more prevalent in respondents who were aged ≤ 19 y/o female, not normal in BMI, either near and far from home, alcohol drinkers, non-smokers, not physically active, single, academically pressured, coffee drinkers, inadequate in n-3 and n-6 fatty acid intake. Among depressed respondents (n=103), 90.29% (n=93) had inadequate n-3 and n-6 fatty acid intake and only 9.71% (n=10) had adequate intake while among respondents who were not depressed (n=98), 70.41% (n=69) had inadequate n-3 and n-6 fatty acid intake and 29.59% (n=29) had adequate intake.

The hierarchical model, which includes all the confounders entered together first before the n-3 and n-6 fatty acid intake variable, has statistically significant relationship with depressive symptoms ($\chi^2=42.26$, $df=11$, $p<.000$) and explained the variation by 19% to 25.3%. (Table 1) presents the results of the logistic analysis performed with the potential confounders. There were four (4) statistically significant variables that explained the model's significant relationship with the dependent variable. These were: age ($p<0.027$), coffee intake ($p<0.003$), academic pressure ($p<0.002$) and n-3 and n-6 fatty acid intake ($p<0.001$), the latter having the strongest predictive power. The odds ratio for n-3 and n-6 fatty acid intake variable was 4.509 which indicates that college students with adequate n-3 and n-6 fatty acid intake are 4.509 times (95% C.I.=1.875 to 10.949) more likely to have no depressive symptoms than college students with inadequate n-3 and n-6 fatty acid intake having allowed the effects of confounding variables. Hosmer and Lemeshow test was finally ran and the results showed [$\chi^2(9) = 6.134$, $0.632 > p$], indicating high goodness-of-fit of the data.

In this study, the factors that significantly contribute to the incidence of depressive symptoms in college students were found out to be coffee intake, academic pressure, age, and n-3 and n-6 fatty acid intake, with the latter being the most significant predictor. The study further validated the results of the few previous studies claiming significant relationship between n-3 and n-6 fatty acid intake and depressive symptoms and added another kind of significant

association between diet and depression to the existing knowledge. Furthermore, the study particularly pointed out that nutrition still plays a very important role in the maintenance and preservation of an individual's well-being, including mental well-being, even in a very complex setting such as college where a lot of other powerful factors can improve or impair health.

Conclusion

Based on the results of the study, it was therefore concluded that there was significant relation between n-3 and n-6 fatty acid intake and depressive symptoms in college students ($\chi^2 = 12.39$, $df=1$, $p<.000$) and that association was independent from the influence of the confounders ($p<0.001$, $df=1$).

Recommendation

It is recommended to have this study replicated with the use of larger sample size, controlling a lot more potential confounding variables that exist in college environment.

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