



(REVIEW ARTICLE)



## Review of Omega-3's Health Benefits in Parkinson's Disease and Students Survey

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### Abstract

In this study, a literature search and review were conducted on the beneficial effects of omega-3 in Parkinson's Disease (PD) along with a survey of pharmacy students. This survey was completed at Howard University College of Pharmacy as part of a Drug Informatics course, where first-year Doctor of Pharmacy students were taught how to conduct literature searches. The literature search retrieved a sufficient number of studies to support the use of omega-3 in PD. Based on this, a survey tool was developed and administered. A total of 42 student respondents participated in the survey. The survey questionnaire incorporated demographics, knowledge, and opinion-based questions. There were a set of knowledge and opinion-based questions included. The results show that on the overall knowledge-based questions, only a little over half of the participants (n=25; 59.5%) answered them accurately, which indicates limited knowledge among the participants. Among the knowledge questions, the highest number of accurate responses (n=30; 71.4%) was acquired for the statement that one should avoid eating foods high in fat or cholesterol while taking omega-3, since they also contain omega-3. Regarding the opinion questions, the respondents were divided evenly (50%; n=21) in most of the opinion questions. The question that acquired the highest variance was the one that refers to the belief that omega-3 supplement reduces the signs and symptoms of PD (mean 2.29±1.02). Overall, even though there are multiple studies that supported the beneficial use of omega-3, in this study, we found a limited knowledge and a wide variance of opinions among the study participants.

**Keywords:** Omega-3; DHA; EPA; Students; Pharmacy; Parkinson's Disease; PD; Survey

### 1. Introduction

Omega-3 DHA/EPA are fatty acids or nutrients with many health benefits. The human body needs these fatty acids present in order to properly function. You can obtain these nutrients from food or supplements that help maintain a healthy body. These supplements are commonly recommended to maintain a healthy heart and have been used along with diet and exercise to help lower levels of certain blood fat and to raise levels of "good" cholesterol<sup>1</sup>. These fatty acids are a good source of energy and keep key organs, like the heart and lungs, working properly. The two major fatty acids, DHA and EPA, are found mainly in certain fish. Omega-3 can also be known as fish oil supplements. These supplements can be used to aid in rheumatoid arthritis, depression, infant development, asthma, ADHD, Alzheimer's disease, and dementia. Some research has shown that omega-3s have a positive effect on memory loss linked to aging. According to new studies, these omega-3 fatty acids protect the brain against Parkinson's disease (PD)<sup>1</sup>.

PD is an extremely diverse disorder. It is a chronic and progressive neurodegenerative condition that usually affects one million middle to late-aged Americans. This disease is characterized by voluntary motor control impairment, tremors, and postural instability. According to the director of the Institute for Cell Engineering, "about 10-20% of PD cases are linked to a genetic cause<sup>2</sup>. It is caused by a loss of nerve cells in the small portion of the brain known as the substantia nigra. Most of the dopamine that the brain uses is produced here. Dopamine is a neurotransmitter that sends messages between nerves that control muscle movements, and it plays a key role in how we as humans feel pleasure. As we get older, cells in the substantia nigra die at a very slow rate, which is completely normal<sup>1</sup>. However, for some people the

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death of those cells occurs rapidly, initiating PD. Some early symptoms of this disease typically start to be visible when 50 to 60% of the cells are gone.

The main drug therapies used for PD include levodopa, dopamine agonists, MAO inhibitor, and catechol-O-methyltransferase (COMT) <sup>3</sup>. Currently, carbidopa-levodopa (Sinemet) is considered the first line of treatment for this disease. Levodopa is a natural chemical that passes into the brain and is then converted to dopamine. Levodopa is combined with carbidopa, which protects levodopa from early conversion to dopamine outside the brain. This lessens side effects such as nausea. Long-term use of Sinemet is limited by motor complications and drug-induced dyskinesia. Dopamine agonists, such as pramipexole, are alternatives for initial treatment. They have been proven to delay the onset of motor complications <sup>4</sup>. Safinamide (Xadago) and Istradefylline (Nourianz) are the latest drugs approved for PD. They are used as an adjunct therapy to levodopa-carbidopa (Sinemet and others) when Parkinson's symptoms are not controlled by that medication alone <sup>4</sup>.

The association between dietary lifestyle and the risk of PD was evaluated in two well-known studies: the Health Professionals Follow-up Study (1986-2002) and the Nurses' Health Study (1984-2000) <sup>6</sup>. The purpose of these studies was to determine if these supplements were effective as an adjunct to the treatment of PD. The results showed that the prudent diet tremendously reduced the risk of PD, while the Western diet did not. The prudent dietary pattern refers to the group that consumes high intakes of fruit, vegetables, and fish. This dietary pattern was inversely associated with PD risk, but the Western pattern was not. The authors concluded that these studies demonstrate an association between an omega-3 fatty acid-rich diet with a lower risk of PD. Omega-3 fatty acids treatment was reported to be safe, effective, and well-tolerated.

There are other clinical studies that examine the use of omega-3 in PD. Observational studies found a correlation between a higher intake of N-3 polyunsaturated fatty acids (N-3 PUFAs) from fish and a lower prevalence of PD. One such study was done by Áden et al <sup>7</sup>. They enrolled eighty-seven patients and 28 age- and sex-matched controls participated in the study. They then assessed the dietary intake by using 3-day dietary records and 24-hour dietary recalls. The Brief Smell Identification Test (B-SIT) was used to test olfaction. The authors reported that they found that PD patients had a significantly lower omega-3 intake.

De Lau et al. also conducted a similar clinical study called the Rotterdam Study which was a prospective population-based cohort study of people ages > or =55 where the association between intake of unsaturated fatty acids and the risk of incident PD was evaluated <sup>8</sup>. After reviewing 5,289 patients' data, the authors found that high omega-3 intake was related to a lower risk of PD.

The same authors also studied the effect of fish oil supplementation on Parkinsonian patients with depression. They used Montgomery-Asberg Rating Scale (MADRS), the Clinical Global Impressions Scale (CGI), and Beck Depression Inventory (BECK) as measuring tools <sup>9</sup>. They used a double-blind, placebo-controlled study and analyzed depression in 31 patients with PD and Major Depression (DSM-IV). In addition to its beneficial effects on PD, the authors also reported that omega-3 supplementation could markedly improve depressive symptoms in PD patients without effect on PD symptoms.

Several reasons have been proposed to support omega-3's beneficial effect in reducing the risk of PD. Firstly, omega-3 has anti-inflammatory, antioxidative, and neuroprotective properties <sup>10</sup>. Secondly, these fatty acids are important components of the cell membrane, which maintain the structure, permeability, and fluidity of membranes, which are important functions for the interaction between genes and proteins, receptors, and channels. Thirdly, n-3 PUFAs are precursors for endogenous cannabinoids, which play a role in the control of movement by modulating dopaminergic activity in the basal ganglia. Finally, genes involved in lipid metabolism contribute to the onset and development of  $\alpha$ -synuclein pathology, the major hallmark in the brains of PD patients.

In addition to its beneficial effect on PD, omega-3 fatty acids have an abundant number of benefits that could improve one's quality of life. However, such a review is outside the scope of this manuscript. On the other hand, there are no or a limited number of studies that reported knowledge of pharmacy or other health care professionals of the connection of omega-3 with PD. Very few to no surveys have been conducted to determine the knowledge of the valuable use of omega-3 in PD or any dietary supplements among pharmacists <sup>11-18</sup>. Therefore, one of the objectives of this study was to address this issue by means of a survey of pharmacy students in their knowledge as well as their opinion concerning the use of omega-3 in PD.

## 2. Methods

The survey enrolled 44 incoming first-year doctor of pharmacy students from Howard University College of Pharmacy. Of the 44 students enrolled in this survey, 42 students submitted responses, with a 95% response rate. The survey was distributed to students during a drug information course. All questions, demographics, and responses were analyzed using Qualtrics. The survey questions consisted of 9 demographic questions, 4 knowledge questions, and 6 opinion questions using the Likert scale (1=strongly agree; 2=agree; 3=disagree; 4=strongly disagree). A mean and standard deviation were calculated for each data set. Demographic data, including age, gender, area of residence, work experience, annual income, and education were collected in the survey. All results were analyzed using IBM SPSS and by utilizing a crosstab, statistical analysis was completed.

## 3. Results

A total of 42 participants completed the survey. The age range for the majority of those who participated in the survey (n=31; 73.8%) was 21-26 years old. Most of the participants were females (n=27; 64.3%) compared to males (n=15; 35.7%). Approximately half (n=24; 57%) reported living within the D.C., Maryland, and Virginia (DMV) areas. Many of the respondents (n=34; 81%) had a bachelor's degree at the time of completing the survey.

**Table 1** Gender, age, residence, education

Demographics	Group	N (%)	Mean (Standard deviation)
Age (years)	21-23	14 (33.3)	3.07 (1.022)
	24-26	17 (40.5)	
	27-29	5 (11.9)	
	>29	6 (14.3)	
Gender	Male	15 (35.7)	1.64 (0.485)
	Female	27 (64.3)	
Residence	Washington, DC	4 (9.5)	2.93 (1.068)
	Maryland	13 (31.0)	
	Virginia	7 (16.7)	
	Other States	18 (42.9)	
Highest Education Attended	Some college	1 (2.4)	3.12 (0.633)
	Associate degree	1 (2.4)	
	BA/BSC	34 (81.0)	
	MSC/MA	4 (9.5)	
	Ph.D./Professional	2 (4.8)	

Participants also ask additional work and income-related questions. The majority of the participants reported they have prior work experience. Half of them stated they were working full time (n=21; 50%), about one-third were working part-time (n=16, 38.1%), and only a small portion of participants stated that they had never worked (n=2; 4.8%) or only worked short-term (n=3; 7.1%).

The type of jobs varied with (n=16; 38.1%) being pharmacy related (n=13; 31.0%), non-healthcare-related (n=12; 28.6%), More than two-thirds (n=29; 69.1%) of the participants earn \$10,000 or more annually.

The number of years worked varied in the study participants. Less than half of the participants (n=19; 45.2%) worked for 1-2 years and most of the participants (n=22; 52.4%) worked for 3-4 years or more than 4 years. The majority of participants (n=18; 42.9%) are not currently working but plan to work soon, whereas the remaining participants (n=15; 35.7%) are not currently working and do not plan to.

**Table 2** Job, income, experience

Demographic	Group	N (%)	Mean (standard deviation)
Job Type	RX related.	16 (38.1)	1.98 (0.897)
	Other healthcare	12 (28.6)	
	Non-healthcare	13 (31.0)	
	Not applicable	1 (2.4)	
Annual Income	< \$10,000	13 (31.0)	2.86 (1.617)
	\$10,001 - \$20,000	7 (16.7)	
	\$20,001 - \$30,000	6 (14.3)	
	\$31,000 - \$40,000	5 (11.9)	
	> \$40,000	11 (26.2)	
Work Experience	Never worked.	2 (4.8)	3.33 (0.816)
	Short-term	3 (7.1)	
	Part-time	16 (38.1)	
	Full-time	21 (50.0)	
Years Worked	Never worked.	1 (2.4)	2.76 (0.878)
	1-2 years	19 (45.2)	
	3-4 years	11 (26.2)	
	> 4 years	11 (26.2)	
Currently working	Yes	9 (21.4)	2.14 (0.751)
	No, but planed soon	18 (42.9)	
	No, no plan working	15 (35.7)	

Table 3 shows the result of the knowledge-based questions. Participants were given four questions to determine their level of knowledge regarding the use of Omega-3 in PD. Overall, a little over half of the participants (n=25; 59.5%) answered the knowledge-based questions correctly, which shows limited knowledge among the participants.

**Table 3** Knowledge-based questions

Survey Statement	Total Correct Responses	Total Incorrect Responses	Mean (Standard Deviation)
Omega-3 is used together with diet and exercise to help lower triglyceride levels. Omega-3 should be taken on an empty stomach.	24 (57.15)	18 (42.85)	2.36 (0.93)
If your patient misses a dose of omega-3, you can advise them to take two doses at one time.	20 (47.62)	22 (52.38)	2.55 (0.99)
Avoid eating foods high in fat or cholesterol while taking omega-3 since they also contain omega-3.	30 (71.43)	12 (28.58)	2.17 (0.99)
An omega-3 fatty acid supplement is known to reduce the signs and symptoms of PD.	25 (59.52)	17 (40.48)	2.29 (1.02)
<b>Average</b>	<b>25 (59.52)</b>	<b>17 (41.07)</b>	

Only about half of the participants (n=24; 57.15%) answered the first question incorrectly (see Table 3), although several studies reported that omega-3 is used together with diet and exercise to help lower triglyceride levels <sup>3</sup>. About half of the participants (n=22; 53.38%) answered the second question correctly. Based on the literature search, if those who missed a dose of this medicine, they are recommended to take it as soon as possible <sup>5</sup>. However, if it is almost time for the next dose, they are to skip the missed dose and go back to the regular dosing schedule. Most recommend not double doses.

Regarding the third question, the majority of participants (n=30; 71.43%) answered correctly. The body does not have the ability to produce omega-3 fatty acids, so it is imperative that individuals receive that from their diet <sup>3</sup>. Foods high in fat or cholesterol should be avoided while taking omega-3 supplementation since it can lead to elevated cholesterol levels as well as increase the risk of PD. Studies have shown individuals with Parkinson's should reduce their intake of cholesterol to help control the symptoms of the condition <sup>6</sup>. They should also reduce the amount of saturated fat in their diet. The final question was answered by about half of the participants (n=25; 59.52%). Some researchers suggest that fish oil may help slow down the progression of Parkinson's <sup>7</sup>. Studies suggest that omega-3 fats may help reduce nerve inflammation, improve neurotransmission, and slow neurodegeneration.

In addition to the knowledge-based questions, survey participants were also asked opinion-based questions. About half (n=22; 52%) responded that you can advise a patient to take two doses of omega-3 at one time if they miss a dose, while 54.8% (n=23) responded that they are familiar with the dose of omega-3 for the management of PD. Both answers were incorrect. On the contrary, 24 (57.17%) correctly believed that omega-3 is used together with diet and exercise to help lower triglyceride levels. When asked if an omega-3 fatty acid supplement was known to reduce the signs and symptoms of PD, the majority responded correctly (n=25; 59.52%). The highest number of correct answers (n=30; 71.43%) was derived when asked if omega-3 should be avoided when eating foods high in fat or cholesterol.

Participants were also given the following (Table 4) opinion-based questions to determine their belief in the health benefits of omega-3. PD is a very serious disease and should be addressed using proven standard medicines. However, half of the participants reported that they agreed to use a natural substance as a first-line therapy. Most participants (n= 29; 69.05%) also agreed with the preference of eating fish and food rich in omega-3 rather than taking a supplement from a pharmacy.

**Table 4** Opinion-based questions

Survey Statement	Responses, N (%)		Mean (Standard Deviation)
	Strongly Agree/Agree	Strongly Disagree/Disagree	
I believe omega-3, a natural substance, should be the first line of treatment for PD.	21 (50.00)	21 (50.00)	2.50 (0.97)
I believe omega-3 supplements are strong and should not be an over-the-counter product.	19 (45.24)	23 (54.77)	2.45 (1.06)
I rather eat fish and food rich in omega-3 than take a supplement from a pharmacy.	29 (69.05)	13 (30.95)	2.19 (0.89)
I believe in screening patients with PD before starting omega-3 since it may cause unwanted side effects.	26 (61.91)	16 (38.10)	2.33 (1.00)
I feel comfortable using or recommending omega-3 for PD.	23 (54.77)	19 (45.24)	2.48 (0.99)
I am familiar with the dose of omega-3 for the management of PD.	19 (45.24)	23 (54.76)	2.62 (1.03)

This table displays the demographic variables such as highest education level, work experience, annual income, and years worked in association with the opinion statements that were significant (p<0.05). These factors significantly contributed to determining whether participants counseled or interacted with patients and their knowledge of dietary supplements.

**Table 5** Significant Demographics Associated with opinion statements

Demographic variable association	P-values
Highest education vs. counseled patients	0.026
Work experience vs. interaction with patients	0.026
Annual income vs. knowledge of dietary supplements	0.005
Annual income vs. interaction with patients	0.043
Years worked vs. interacted with patients	< 0.001

Table 6 displays the demographic variables such as highest education attended and annual income in association with the knowledge statements that were significant ( $p < 0.05$ ). The association between the highest education attended and comfortability on recommending omega-3 for PD as well as whether omega being taken on an empty stomach was significant. The association between annual income and familiarity with the dose of omega-3 for managing PD was also significant.

**Table 6** Significant Demographics Associated with knowledge statements

Demographic variable association	P-values
Highest Education Attended vs. Omega-3 is used together with diet and exercise to help lower triglyceride levels. Omega-3 should be taken on an empty stomach.	0.040
Highest Education Attended vs. I feel comfortable in using or recommending omega-3 for PD.	0.017
Annual Income vs. I am familiar with the dose of omega-3 for the management of PD.	0.010

#### 4. Discussion

In this study, an attempt was made to address two objectives. The first is to review the literature on the beneficial effects of omega-3 supplements or omega-3-rich diets on reducing the symptoms and progression of PD. It seems there are a number of studies in support of the use of omega-3 in patients with PD. The other objective of this study was to determine the knowledge and opinion of pharmacy students related to the general knowledge of the use of omega-3 and its association with PD.

The survey results show that only half of the survey participants have some level of knowledge regarding omega-3 or its use in PD. Despite their limited knowledge, about half of the students believed that omega-3 should be the first-line treatment for PD. On the other hand, the majority of the students would rather eat fish/food rich in omega-3 than take a supplement from the pharmacy. Although omega-3 is relatively safe and present in most food items, about 62% of the students believed in screening patients with PD before starting omega-3 supplements. Despite their differences, overall, the majority of the students (54.77%;  $n=23$ ) feel comfortable recommending omega-3 for PD.

Regarding the opinion questions, the respondents were divided evenly (50%;  $n=21$ ) in a majority of the opinion questions. The question that collected the highest diversity was the belief that omega-3 supplements reduce the signs and symptoms of PD (mean 2.29+1.02). Overall, although there are a variety of studies that supported the beneficial use of omega-3, there was limited knowledge and opinions varied among the survey participants.

#### 5. Conclusion

There were various studies that supported the use of omega-3 in PD. However, the result of a survey of 42 first-year Doctor of Pharmacy students demonstrated that there is limited knowledge and differing opinions among the survey participants, considering only a little over half had a good level of understanding of the knowledge-based statements. For example, twenty-four (57.1%) correctly thought that omega-3 should be taken on an empty stomach, as well as be used together with diet and exercise to help lower triglyceride levels and twenty-five (59.5%) believed that omega-3 fatty acid supplements are known to reduce the signs and symptoms of PD. The opinions for the other 5 opinion-based questions varied significantly among the survey participants. Even though the small number of participants in this study

is viewed as a limitation, the outcome may need to involve the inclusion of such topics beforehand in the pharmacy curriculum.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

The study was approved by the Howard University IRB and done as a part of a course. Therefore, there was no need to obtain informed consent from all individual participants included in the study.

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