THE IMPORTANCE OF CONSUMING OMEGA 3 FATTY ACIDS:
THE DEVELOPMENT OF A NUTRITION AND EDUCATION CURRICULUM
FOR PREGNANT AND BREASTFEEDING WOMEN

A project submitted in partial fulfillment of the requirements
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Family and Consumer Sciences

by
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DEDICATION

This graduate project is dedicated to:

My family: your love, support and constant encouragement has helped me to see the light at the end of the tunnel. You always offer me a shoulder to lean on, or even more importantly, to cry on. Thank you so much for making me the strong woman I am today.

Barak Volner: thank you for your unconditional love, support, and for being my editor. You are always there for me, especially during my darkest moments. While there were many moments where I lost my confidence, you were always there saying exactly what I needed to hear. You are my rock, and I would not be here right now if it wasn’t for your constant support. I am so lucky that you are my other half.
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ABSTRACT

THE IMPORTANCE OF CONSUMING OMEGA-3 FATTY ACIDS:
The Development of a Nutrition and Education Curriculum for Pregnant and Breastfeeding Women

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Family and Consumer Science

The prevalence of omega-3 fatty acid deficiency is a growing public health concern. In an effort to address this problem, a curriculum to increase knowledge in omega-3 fatty acids was created for Northeast Valley Health Corporation’s Women Infant Children (WIC) program for future use with pregnant and/or breastfeeding participants.

The purpose of this project was to develop five, 15-minute lessons for group presentations or one-on-one counseling with Northeast Valley Health Corporation’s WIC participants in San Fernando Valley, California. The director of the WIC program and two professors from the California State University, Northridge, who each hold a doctorate in a nutrition-related field and the RDN credential, evaluated these lessons. The ultimate goal was to improve the intake of omega-3 fatty acid rich foods. Further research is suggested to evaluate effectiveness of the curriculum and whether the audience comprehended the information provided.
CHAPTER I
INTRODUCTION

Omega-3 fatty acids (omega-3s; ω-3s) are dietary compounds found in a variety of foods that are essential for the human body and, thus, must come from dietary sources (Erdman, Macdonald, & Zeisel, 2012). Omega-3s have been shown to play a role in many of our body’s systems (Mason, 2012), such as cognitive function and decreasing inflammation. Forms of omega-3s include α-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). The United States Department of Agriculture’s [USDA] 2010 Dietary Guidelines for Americans recommends consuming 250 milligrams (mg) each of EPA and DHA per day (Mason, 2012). Nutrient-dense sources of omega-3 fatty acids include fish and seafood (Mason, 2012). The American Heart Association (AHA) recommends that individuals eat a variety of fish at least twice a week for adequate omega-3 intake (American Heart Association, 2014). According to the USDA’s 2010 Dietary Guidelines for Americans, the average seafood intake in the United States is approximately 3.5 ounces per week, notably less than the recommended minimum of 8 ounces per week, or about 250 mg per day (USDA, 2010).

A deficiency of omega-3 fatty acid intake has been linked to increased risk of cardiovascular disease, metabolic syndrome, type II diabetes, dementia and Alzheimer’s disease, arthritis, and possibly allergies (Mason, 2012). Adequate intake of omega-3s is especially important for infants, because this is the most rapid stage of development during one’s lifetime (Mason, 2012; Erdman, Macdonald, & Zeisel, 2012). Dietary intake of omega-3 fatty acids during pregnancy and breastfeeding is positively correlated to the infant’s omega-3 fatty acids levels. Further research demonstrates that adequate fetal and
infant levels of omega-3 fatty acids may help with brain, vision, and cognitive development, and may decrease risk for allergies, asthma, and eczema (Mason, 2012).

While it is known that omega-3 fatty acids are important throughout one’s lifetime, many individuals are unaware of the importance it has in breastfeeding (Erdman, Macdonald, & Zeisel, 2012). A meta-analysis by Anderson, Johnstone, and Remley (1999), supports the importance of dietary consumption of omega-3 fatty acids. Anderson et al.’s meta-analysis conclusions suggest that, by contrast, delivery of omega-3 fatty acids via fortified formula did not have a beneficial impact on infant cognitive development. In another meta-analysis by Qawasmi, Landers-Weisenberger, Leckman, and Bloch (2012), findings suggest that the most beneficial source of the nutrient, which comes mainly from the maternal diet, is through breast milk. It is therefore important to teach pregnant and breastfeeding women the importance of consuming omega-3 fatty acid-rich foods.

**Statement of the Problem**

While it is becoming more apparent that consumption of omega-3 fatty acids is important, there seems to still be a gap in the literature regarding the delivery of information, about omega-3 fatty acids, to pregnant and breastfeeding women. This lack of knowledge combined with lack of education programs that emphasize the importance of omega-3 fatty acids may hinder adequate nutrition intake among this population.

**Purpose**

The purpose of this project was to develop a nutrition education curriculum for pregnant and breastfeeding women to teach them the benefits of omega-3 fatty acids. The goal was to provide the nutrition education in a class setting for both pregnant and
postpartum women. As part of the curriculum, several informational and activity handouts were also developed to reinforce the information that was presented. The ultimate goal is to improve the intake of omega-3 fatty acid rich foods.

**Justification**

This project may help increase curriculum available on the subject of omega-3 fatty acids for pregnant and breastfeeding women and therefore potentially aid in increasing the consumption of omega-3 fatty acids among this population. Increased consumption of omega-3 fatty acids could positively impact the healthy development of the infant.

**Definitions**

1. **ALA**: α-linolenic acid, an 18-carbon polyunsaturated fatty acid that is only found in vegetables. It is the parent polyunsaturated fatty acid of the omega-3 fatty acid series. A great source is flaxseeds, which have been used to treat constipation and other bowel disorders (Mason, 2012).

2. **DHA**: Docosahexaenoic acid, an omega 3 that is made from α-linolenic acid (ALA) found predominantly in animals, can be synthesized in the body in small amounts. Oily fish is the best source, but another nutrient dense source is algae (Mason, 2012).

3. **EPA**: Eicosapentaenoic acid, omega-3 that is found in fish, is a precursor to DHA, and can be synthesized in the body from ALA. It is also a precursor to prostaglandin-3, which inhibits platelet aggregation (Mason, 2012).
4. Exclusively breastfed: An infant who receives nutrition only via breast milk until the age of six months; no supplementation of food, formula, water or any other substance (Ward, 2009).

5. Infant development: The process of growth of an infant from time it is conceived until it is a one year old (Ward, 2009).

6. Methylmercury: Coming from a metal known as mercury, it is toxic and enters the food chain through fish consumption (Ward, 2009).

7. Omega-3 fatty acids: A group of fats that is found in fish, dark leafy greens, and nuts. It is also known as n-3 polyunsaturated fatty acid and is essential for the human body. The “3” comes from it having its first double bond on the third carbon from the methyl group. The World Health Organization (WHO) recommends that 250-500 milligrams of omega-3 fatty acids be consumed per day (Mason, 2012).

8. WIC: The Special Supplemental Nutrition Program for Women, Infants, Children is a federal program that provides supplemental foods, nutrition education, referrals, and breastfeeding support for low-socioeconomic families, specifically women, infants, and children up to the age of five years old. Participants include pregnant women, breastfeeding women up to 1 year postpartum (if not breastfeeding, only 6 months postpartum), and infants from birth through 5 years old. (Women, Infants, and Children, 2015).

**Assumptions**

This curriculum was developed based upon the following assumptions.

- Participants willingly participate in these classes.
• Participants will be pregnant and breastfeeding.
• Participants will be able to understand English and basic nutrition concepts as presented in the education lectures.
• Participants will be able to read and understand English as presented in the lectures.
• The nutrition intervention program will promote changes in participants' eating behaviors.
• Participants will attend at least three-quarters of the education sessions.

Limitations

The curriculum has the following limitations.

• The curriculum was designed for women who are pregnant or breastfeeding and may not be applicable to other individuals.
• The curriculum was only created to improve the consumption of omega-3 fatty acid rich foods.
• Cultural beliefs of the individuals in the classes could impact the way they receive the education.
• Family and social influence could also cause a barrier, specifically if they do not support the woman in her desire to consume more omega-3 fatty acid foods.
• The material was only developed in English and more than 90% of the participants at NEVHC WIC are Hispanic.
CHAPTER II

REVIEW OF LITERATURE

This chapter provides a review of the existing research about omega-3 adequacy in pregnant and breastfeeding women to gain better insight into the problem. This curriculum will contribute to the current education available to the public for interventions that may reduce deficiency in this specific targeted population. The literature review will facilitate the development and implementation of the curriculum and will include omega-3 fatty acid deficiency prevalence, causes of deficiency and how it relates to pregnancy and breastfeeding specifically, and possible solutions and interventions to the omega-3 fatty acid deficiency.

**Prevalence of Omega-3 Fatty Acid Deficiency**

Over the years, awareness of the importance of omega-3 deficiency has increased significantly (Erdman, Macdonald, & Zeisel, 2012). According to the USDA Dietary Reference Intakes of Macronutrients (2005), the adequate intake (A.I.) level for omega-3 fatty acids is 1.4 grams per day during pregnancy and 1.3 grams per day for lactating women. While the recommendations are known, this doesn’t necessarily correlate to what is being consumed in the United States. According to the National Health and Nutrition Examination Survey (NHANES 2003-2008), in the United States, the average adult’s median intake of fish was 0.43 ounces (12.19 grams) per day; more specifically, their average intake of fish high in omega-3 fatty acids was 0.07 ounces (1.99 grams) per day (Papanikolaou, 2014). This study also showed that women had a lower intake of fish compared to men, with women averaging 0.13 ounces (3.69 grams) of high omega-3 fish compared to males' intake of 0.18 ounces (5.1 grams) per day (Papanikolaou, 2014).
Intake of DHA and blood levels of DHA in the United States are among the lowest in the world (Mahaffey et al., 2011). The average DHA percent of total fat in America was 0.15%, which is approximately 0.1 gram. The only countries in this study that had lower intakes were Pakistan, Canada, and rural South Africa (Brenna, Varamini, Jensen, Diersen-Schade, Boettcher, & Arterburn, 2007). Conversely, countries with the highest DHA were Japan, Canadian Arctic, and Dominican Republic (Brenna et al., 2007). The concern that the omega-3 intake of so many individuals is inadequate compared to the rest of the world underscores a need for further research regarding the implications and prevention of inadequate omega-3 intake.

A recent study in Canada showed how prevalent omega-3 fatty acid deficiency truly was throughout pregnancy and postpartum (Jia et al. 2014). In the study, 503 women completed 24-hour food recalls every trimester and three months postpartum to establish their average omega-3 fatty acid consumption. Of the subjects, only 13% (P < 0.001) met the European Union consensus recommendations of 200 milligrams per day of DHA for both pregnancy and three months postpartum (Jia, et al. 2014).

Omega-3 fatty acids may be an essential nutrient promoting cognitive development in the growing infant. Since breast milk omega-3 content largely depends on the omega-3 dietary intake of the lactating mother, it is important to ensure adequate intake among this population (Erdman, Macdonald, & Zeisel, 2012).

**Conversions of Omega-3s in the Human Body**

Omega-3 and omega-6 are polyunsaturated fatty acids (PUFA) are essential for humans, and as such, must come from diet (Erdman, Macdonald, & Zeisel, 2012). All omega-3 PUFAs start as α-linolenic acid (ALA), and all omega-6 PUFAs start as linoleic
acid. Through several elongase and desaturase enzymes, they form eicosapentaenoic acid (EPA), and through more of the same enzymes become docosahexaenoic acid (DHA) (Kremmyda, Vlachava, Noakes, Diaper, Miles, & Calder, 2011). These conversions vary genetically between individuals. The rate-limiting enzymes for making EPA and DHA are δ-6 desaturase and δ-5 desaturase and are controlled by the genes FADS2 and FADS1 (Lattka et al., 2011). Single nucleotide polymorphism affects the FADS gene cluster associated with essential PUFA synthesis concentrations in serum, plasma, erythrocyte, membranes, and adipose tissue (Lattka et al., 2011). While genetics plays a role in the conversion of ALA to EPA and DHA, many other factors also affect the conversion. Gender has been shown to change this conversion, because females are able to make the conversion more readily than males (Mahaffey et al., 2011). Disease and exposure to environmental contaminants like drugs also impact this conversion (Mahaffey et al., 2011). Table 1 shows the content of omega-3 fatty acids, as well as mercury levels, in different seafood.

**Importance of Breast Milk and Omega-3 Fatty Acid for Infants**

The World Health Organization (WHO) estimates that more than 1.5 million infant deaths could be avoided every year if all babies were breastfed (Willumsen, 2013). In the United States, an industrialized nation, it is estimated that nearly 1,000 infant deaths per year could be avoided if they had received breast milk for the first six months of their lives (Bartick & Reinhold, 2010).

According to WHO, high breastfeeding rates have been shown to decrease infant hospitalization, vomiting and diarrhea, acute ear infections, asthma, eczema, diabetes type 1 and type 2, Sudden Infant Death Syndrome (SIDS), childhood obesity, and Acute
Lymphocytic Leukemia (Horta & Victora, 2013 a and b). An estimated $13 billion dollars could be saved yearly in health-care expenses each year (Erdman, Macdonald, & Zeisel, 2012).

Breast milk contains much of what an infant needs nutritionally for the first six months of life, including antibodies, anti-cancer compounds, growth factors, enzymes, disease-fighting stem cells, omega-3s, and about 200 other components, some that have not yet been identified (Lauwers & Swisher, 2011; Mohrbacher, 2010). The compounds in breast milk are being researched, particularly omega-3s, which are important in the development of the infant and are better obtained through the consumption of breast milk than through infant formula (Erdman, Macdonald, & Zeisel, 2012). In a study on preterm
infants fed breast milk versus formula, the omega-3 fatty acids blood levels for breastfed infants were, on average, 9.0 molar percent compared to 6.6 molar percent noted in formula-fed infants (Carlson, Rhodes, & Ferguson, 1986).

Inadequate intake levels of omega-3 fatty acids have been linked to increased allergic disease, poor growth, decreased IQ scores, increased blood pressure levels, increased cardiovascular disease, increased severity of mental illness, and increased stress/inflammation (Lattka et al., 2011; McColl, Dhillon, & Howard, 2012; Morse, 2012; Quinn & Kuzawa, 2012). A meta-analysis showed an inverse association between omega-3 fatty acids and cerebrovascular risk (Chowdhury et al., 2012). Another research study showed that increased consumption of omega-3 fatty acids from birth to six months of age has a positive immunomodulatory and allergy-protective property (D’Vaz et al., 2012). Sufficient omega-3 is important for decreased cardiovascular disease, improved central nervous system, improved neurodevelopment, neural growth, cognitive function, neuron and retinal cells, visual acuity, higher IQ scores, cell membrane formation, integrity and function, function of the brain, retina, liver, kidney, adrenal glands, and gonads, local hormone production for the regulation of blood pressure, and immune/inflammatory response (Luxwolda, Kuipers, Sango, Kwesigabo, Dijick-Brouwer, & Muskiet, 2012; Mahaffey et al., 2011; Quinn & Kuzawa, 2012).

Many of these benefits arise from omega-3 fatty acid’s many functions. About 60% of the brain is composed of fat, and the long chain polyunsaturated fatty acids (LCPUFA) that permit normal function (Morse, 2012) account for most of that fat. DHA is needed for nerve cells, specifically cell message transmissions, forming secondary messages and responses to neurotransmitters (Morse, 2012). It has been shown that DHA
is important in decreasing scaffolding protein losses and lipid peroxidation, which helps maintain the physical structure of the brain (Morse, 2012).

A study in the Seychelles, where the population has high fish intake and is known to eat 12 or more servings of fish per week, found no adverse association between prenatal methyl mercury exposure and neurodevelopmental outcomes (Strain et al., 2015). The high DHA intake was positively associated with language development (Strain et al., 2015). These populations were known to eat a variety of fish; not all of them considered low mercury seafood. It seemed in this population that the omega-3 fatty acid outweighed the negative impact of methyl mercury exposure and the psychomotor developmental index. This benefit of omega-3 fatty acid without the negative effect of mercury may be correlated to selenium. The selenium in fish can inhibit the absorption of mercury due to selenium’s high affinity to mercury (Ralston, 2009; Raymond & Ralston, 2004). By selenium sequestering mercury, resulting in mercury-selenides, it reports a reduction of its biological availability and therefore prevents the negative side effects of mercury (Ralston, 2009; Raymond & Ralston, 2004).

During the second half of pregnancy and after the birth of the child, DHA concentrations and DHA stores start to decrease (Bergmann et al., 2008; Luxwolda et al., 2012). DHA concentrations decreases at a steady pace during the months postpartum, but experts agree that consuming 100 to 300 mg of DHA a day prevents this decreased storage. Mothers’ dietary habits are the main source of omega-3s in breast milk, which puts emphasis on consumption (Bergmann et al., 2008; Lattka et al., 2011).

The time it takes for a meal to affect maternal breast milk has been established to be a maximum of 10 hours when the mother is consuming two to eight grams of fish oil
either through food or supplementation (Lauritzen, Jorgensen, Hansen, & Michaelsen, 2002). The same impact was also seen in a few other studies after the mother consumed 1 gram of fish oil or half a gram of algal oil (Lauritzen et al., 2002). It is vital to discover ways to increase omega-3 consumption and an alternative to consumption of seafood and fish oil supplementation that would still have a significant impact of breast milk lipid composition.

**Lack of Omega-3 Fatty Acids Education**

According to the *Dietary Guidelines for Americans 2010*, the mean intake of seafood in the United States is about 3.5 ounces of fish per week, while the recommendation is at least 8 ounces per week (U.S. Department of Agriculture, 2010). While the aforementioned has shown the importance of omega-3 fatty acids, an educational component still seems to be missing.

In 2004, the Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) advised pregnant women, breastfeeding mothers, young children, and women who may become pregnant not to consume fish high in mercury and not to consume more than 12 ounces of low-mercury fish per week (Lando, Fein, & Choiniere, 2012). However, an investigation by Lando et al. (2012) showed that consumption was significantly lower than the recommended intake level. Pregnant women consumed on average 1.8 ounces per week, postpartum women ate 2.5 ounces per week, and the control group ate 3.0 ounces per week (Lando et al., 2012).

In another study, university students were asked about the benefits of fish consumption (Burger & Gochfeld, 2008). When asked open-ended questions, 16% of the subjects did not know what the benefits of eating fish were, and 62% did not have
specific information about why there were warnings (Burger & Gochfeld, 2008). About 40% were able to correlate the benefits of omega-3 fatty acids as brain food, but less than half were able to differentiate between low and high mercury fish (Burger & Gochfeld, 2008). The confusion between people being aware of the risks and benefits of fish consumption was found to be due to insufficient details, suggesting the need for better education. To provide the public with sufficient information to make sound decisions, more education is needed to provide clearer, more direct messages about with fish intake decisions (Burger & Gochfeld, 2008). In 2005, a study in Denver, Colorado, investigated an intervention conducted at WIC with 47 women in a focus group called "Omega-3 for Baby and Me", with the positive outcomes of decreased incidence of preterm birth and low-birth weight (Troxell, Anderson, Auld, Marx, Harris, Reece, & Allen, 2005).

The Northeast Valley Health Corporation WIC is approximately 90% Hispanic and/or Latino, however, the lessons are only in English which may be a limiting factor. While many of the Hispanic or Latino population speak and understand English, the participants that are only Spanish speaking may not be able to receive this education. This is significant because according to United States Census Bureau, Los Angeles County is 48.3% Hispanic or Latino (2015).

**Omega-3 Fatty Acids and Human Ecological Theory**

The lack of intake of foods high in omega-3 fatty acids in the United States is complex because no single factor accounts for this problem (Erdman, Macdonald, & Zeisel, 2012). The underlying causes of decreased intake could be due to distaste of fish, vegetarian diets, lack of fish consumption, or other reasons unknown. The simultaneous interactions among these factors contribute to the prevalence of the nutrient deficiency
At its most basic level, deficiency of omega-3 fatty acids is due to lack of consumption of foods high in omega-3 fatty acids. To understand that women’s lack of intake of omega-3 fatty acids is not only impacted by how and what they eat, but also how their surrounding environment supports the woman during her changes in dietary behavior, and how that influences their dietary intake. Hence, it is essential to study and understand the Human Ecology Theory (HET) proposed by Bronfenbrenner in 1979.

Bronfenbrenner’s theory identified five environmental systems that can be evaluated and interpreted relative to the mother-to-be. These systems are interrelated, and, according to the theory, this relationship shapes the individual’s behavior and development. At the same time, the individual can influence the structure in each system. The theory emphasizes that the environment plays a major role in an individual’s development. Figure 1 depicts the five environmental systems.

![Figure 1. Human Ecological Model. This figure illustrates the model according to Bronfenbrenner (1979).](image)
This innovative theory explains how the multiple environment structures surrounding the women could affect their individual omega-3 fatty acid status. This model is essential to understanding the joint effects of family, individual, and society as casual factors of omega-3 deficiency.

The closest system to the woman’s omega-3 fatty acid status is the genetic environment and the woman's individual characteristics and risk factors, including age, genetic susceptibility to deficiency, dietary restrictions (vegetarian/vegan), and food likes and dislikes. Women with families that consume more omega-3 fatty acids are more likely to themselves consume foods high in omega-3 fatty acids (“Omega-3 Fatty Acid and Health”).

The next system influencing the woman’s omega-3 fatty acid levels is the family environment, which includes the family's characteristics. Specific structures in the system encompass the food preferences of the family (e.g. husband), dietary intake, nutritional knowledge, preference to omega-3 fatty acid foods, types of foods available at home, and so forth. The interactions of these factors may affect the woman’s omega-3 fatty acid levels since family environment has a great impact in her behavior. (“Omega-3 Fatty Acid and Health”).

The outermost system represents the community, demographic, and society characteristics, including ethnicity, socioeconomic status, work environment, education programs, accessibility of grocery stores, convenience stores, and restaurants, and work hours. While these specific factors were not in any literature reviewed, they may also be associated with omega-3 fatty acid deficiencies.

After analyzing the HET, we can understand that an individual’s environment can
have a tremendous impact on individuals, resulting in an impact of the woman’s diet and her omega-3 fatty acid status. Therefore, it is important to increase the nutrition knowledge regarding the importance of omega-3 fatty acid intake, not only for the individual woman, but also for those within a woman’s environment.

The prevalence of omega-3 fatty acid deficiency is a concern in the general public, and even more so in both the maternal and infant populations. There are some genetic factors that play a role in the conversion process, however, the main hurdle that was stated above is the lack of omega-3 fatty acid consumption in the American diet. This can also be linked to the lack of knowledge of the importance of omega-3 fatty acid intake.

The curriculum presented in this project is designed to lead to increase in knowledge of the importance of omega-3 fatty acid consumption for pregnant and breastfeeding women, along with education on how to decrease consumption of high methyl mercury fish. Increasing women’s nutritional knowledge and teaching them how to consume fish safely will hopefully lead to an increase in consumption of omega-3 fatty acids, which is the goal of this program.
CHAPTER III

METHODOLOGY

Existing research emphasizes the importance of adequate omega-3 fatty acid intake among pregnant and breastfeeding women (Luxwolda, Kuipers, Sango, Kwesigabo, Dijick-Brouwer, & Muskiet, 2012; Mahaffey et al., 2011; Quinn & Kuzawa, 2012). The purpose of this project was to develop a nutrition-based education curriculum for pregnant and breastfeeding women to teach them the benefits of omega-3 fatty acids. The curriculum is aimed at improving the eating behaviors of pregnant and breastfeeding women by increasing their consumption of omega-3 fatty acid foods. The goal of the curriculum is to reduce negative outcomes associated with inadequate omega-3 fatty acids in the Los Angeles area of Southern California.

Curriculum Development

This project includes the development of a nutrition-based education curriculum for implementation in classrooms in the San Fernando Valley, Northeast Valley Health Corporation (NEVHC), which includes the staff at the Supplemental Program of Women, Infants, and Children (WIC). The first step in the development was selecting a health topic that would be appropriate for WIC participants. At this point, both the director of the NEVHC WIC and the WIC Regional Breastfeeding Liaison approved the topic of omega-3 fatty acid. With the proposed curriculum topic approval, the outline was developed for the lesson plan (Appendix I). Then the learning objectives were developed. The next step was the development of one PowerPoint presentations according to the curriculum outline. This curriculum was reviewed by both the director of the NEVHC WIC and the WIC Regional Breastfeeding Liaison. Once approved, a trial lesson was
presented to over 200 WIC staff members. After the presentation evaluations were e-mailed to the staff. The comments from the WIC staff about the trial lesson were favorable. The staff members asked for the recipes presented in the lesson and some specifically asked for more information on omega-3 fatty acids. One staff member made a comment about the handout having a grammatical error, which was corrected. The next step was to extend the content from the initial PowerPoint presentation to 5 separate lessons, each including a PowerPoint presentation and interactive activities. Once the five PowerPoint presentations were finalized with activities and handouts (Appendix J, K, L, M, N, O), they were submitted for review to the Formative Evaluation Committee.

**Formative Evaluation**

**Expert Evaluation**

The curriculum was designed to educate participants about omega-3 fatty acids and therefore requires an evaluation from experts knowledgeable about nutrition education. The expert panel was composed of the NEVHC WIC Director and two Nutrition Educators whom are California State University, Northridge, Professors with previous experience and education in nutrition, dietetics, and childhood and/or maternal nutrition. The panelists provided feedback on the clarity and efficacy of the curriculum content.

**Expert Review Procedures**

The panelists were chosen due to their prior knowledge in the field, specifically working with WIC and/or public health care programs targeting similar populations. Each member was provided with lessons one through five, including presentations, lesson plans, questionnaire, activities, handouts, and formative evaluation (Appendix A, B, C, D,
E, J, K, L, M, N, & O). Panelists were given nine days to review the lessons and provide their feedback on the review forms. No monetary contributions were given to the panelists upon providing their recommendations.

**Expert Review Measurements**

The expert panel evaluated lessons one through five by completing the Formative Evaluation Survey (Appendix F, G, H). The Formative Evaluation Survey requests the panelists to state their age, gender, ethnicity, expertise, highest education level, employment, and expertise working with pregnant and/or breastfeeding women. The Expert Review Forms inquired the panelists to rate the curriculum based on a 1 to 5 rating scale concerning the accuracy and effectiveness of the curriculum. The ratings included 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, and 1=Strongly Disagree. The panelists are then asked to add any additional comments or recommendations they may have about the curriculum.

**Expert Characteristics**

Each member worked in a role involving the development or administration of curriculum. The paragraph below provides a description of their specific job title and responsibilities as well as their descriptive characteristics (i.e. gender, ethnicity, age, and education level). Each panelist was designated as member “A,” “B,” and “C.”

Panel member “A,” is a 40-49 year old White, Non-Hispanic female. Their expertise involves MCH nutrition and pediatric nutrition. Their highest level of education is a Ph.D. and current position of employment is university/college professor. They have experience working with pregnant and/or breastfeeding women.
Panel member “B,” is a 30-39 year old White, Non-Hispanic female. Their expertise involves nutrition. Their highest level of education is a Ph.D. and their current position of employment is university/college professor. They have not had experience working with pregnant and/or breastfeeding women.

Panel member “C,” is a 40-49 year old Asian/Pacific Islander female. Their expertise involves curriculum & nutrition. Their highest level of education is a MPH and Their current position of employment is the director of WIC program. They have experience working with pregnant and/or breastfeeding women.
CHAPTER IV

RESULTS

Chapter IV presents the results for this project. The purpose of this project was to develop five comprehensive educational classes to be implemented among women who are pregnant and/or breastfeeding. The final curriculum includes five 15-minute education presentations with handouts and activities for participants to refer to (Appendices A, B, C, D, E, P, Q, R, S, T).

Once the PowerPoint drafts were revised, two professors from CSUN, and the director of NEVHC WIC reviewed the five lesson plans. Subsequently, final PowerPoint presentations were created, incorporating the modifications.

Results from the Expert Review

The table below summarizes the average rating of the three panelists from the Expert Review Form. The completed reviews can be found in Appendix F, G, & H.

5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, and 1=Strongly Disagree.

<table>
<thead>
<tr>
<th>Curriculum Evaluation</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Average Rating</th>
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</thead>
<tbody>
<tr>
<td>The curriculum topic was researched and displayed well:</td>
<td>3</td>
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</tr>
<tr>
<td>The curriculum was clear and concise:</td>
<td>4</td>
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</tr>
<tr>
<td>The curriculum content was presented in an effective manner:</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3.67</td>
</tr>
<tr>
<td>The curriculum was appropriate for its target audience:</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3.67</td>
</tr>
<tr>
<td>The curriculum was easy to understand:</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4.00</td>
</tr>
<tr>
<td>The Student Handbook and other lesson handouts supported the curriculum appropriately:</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4.33</td>
</tr>
<tr>
<td>The material used in the curriculum was cited and referenced properly:</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3.67</td>
</tr>
</tbody>
</table>
The results from the additional comments and recommendations from the Expert Review Form are summarized below.

- Panel Member “A” commented that all of the presentations needed more citation, inclusive of the recipes if they were not originals.

- Panel Member “B” commented that there needed to be some clarification with the ratio of omega-3 to omega-6 fatty acids, font changes, rephrasing certain slides, changes to the questionnaire and crossword, and adding information on selenium inhibiting mercury poisoning.

- Panel Member “C” commented that it was too lengthy, the literacy level was too high, and that it was too technical. They suggested to simplify the language by using fewer technical words, that there needed to be more citations, more pictures in lessons, to match the lesson plan and slides in a better way, include an overview at the start of each lesson, condense the five lessons into one, and make the lesson more interactive.

The omega-3 fatty acid curriculum for WIC participants was modified. The modifications included adding citations to all five lessons, which was a concern from both experts “A” and “C.” Expert “C” also suggested amending the high literacy verbiage into a more simple level of literacy. Expert “C” further suggested adding pictures to the majority of the slides as well as an overview to the beginning of each lesson.

There were additional specific lesson modifications. In lesson one, changes were made to the font as well as the clarifications on the ratio concept of omega-3 fatty acids to omega-6 fatty acids as per expert “B’s” suggestions. In lesson two, certain slides’ verbiage needed to be amended as well as font changes were requested to be made.
consistent throughout the lesson as per Expert B. Lastly, adding information on selenium inhibiting mercury poisoning that was mentioned by expert “B” was changed in lesson three.

The finalized curriculum contains five nutrition education lessons (Appendix A, B, C, D, & E) designed to be presented during five 15-minute workshops. In the future, it is recommended to determine the effect of this curriculum on the knowledge and behaviors of the target populating using a pre- and post-test. Also, translating the curriculum to other languages, specifically Spanish, would expand the population that could participate.
CHAPTER V

DISCUSSION

The purpose of this project was to develop nutrition-based education curriculum to emphasize the benefits of omega-3 fatty acids. The curriculum is to be presented to pregnant and/or breastfeeding women that are WIC participants. A review of the presentation is provided in this chapter.

Summary of the Problem and Purpose

The high prevalence of omega-3 fatty acid deficiency rates across America is a growing public health concern (Mahaffey et al., 2011; Lando et al., 2012). The average American diet is poorly balanced with respect to the ratio between omega-3 fatty acids and omega-6 fatty acids. Given the aforementioned, the inadequate knowledge about omega-3 fatty acids may continue to create continued decline of a well balanced diet (Erdman, Macdonald, & Zeisel, 2012). The American Heart Association [AHA] (2014) recommends that the average American consume fish at least twice a week for sufficient omega-3 intake. Effective intervention programs addressing this issue are important in our society. Other WIC programs affirmed the benefit of better education delivery methods to pregnant and breastfeeding women (Troxell et al., 2005). This proposed nutrition-based education curriculum has the potential of delivering critical information regarding the benefits of consuming omega-3 fatty acids, specifically during this duration of a woman’s life.

According to the 2003-2008 NHANES study (Papanikolaou, 2014), the average adult in the United States consumed approximately 0.07 ounces per day of fish that was sufficient in omega-3 fatty acids. It also reported that women consumed significantly less
omega-3 fatty acids than males. There is not enough nutrition-based education programs aimed at providing knowledge of the importance of omega-3 fatty acids.

**Expert Review Summary**

This project received ratings ranging from 3.67 to 4.33, and, thus varied among members of the Formative Evaluation Committee. The majority of the lower scores were from expert “C,” who considered the literacy level needed to comprehend the curriculum too high. Also, expert “C” expressed a preference for presenting the information in one class. Prior research on effective teaching practices, however, suggest that this strategy of compressing content in one long session may not be conducive to optimal learning (Brown & Race, 2002). Instead, dividing the content into smaller chunks of information, with review of prior content, may better help participants retain the material and grasp the concepts (Brown & Race, 2002).

A 3.67 average score was given for the following (a-d): (a) “The curriculum topic was researched and displayed well.” Experts “A” and “C” indicated that citations needed to be added; which were subsequently added to each lesson. Researching topics is critical because it’s a non-subjective form of determining accuracy of information. Its important to be displayed well to better advise the participants in an interactive and simplified manner. (b) “The curriculum content was presented in an effective manner.” Expert “B” indicted that clarification was needed on the ratio between fatty acids as well as additional information needed on lack of absorption of mercury due to selenium intake. Expert “C” indicated that the lessons were too lengthy and that they were written in high literacy. Expert “C” further indicated that additional illustrations were needed.
The aforementioned items have been revised and addressed except for the lengthiness of the lessons.

It is questionable whether the lessons should be combined into a single project as different WIC agencies have different class structures. It is important to provide the curriculum effectively and in a way that is conducive to the learning process. It is also advantageous for the information to be concise to limit confusion, on case-by-case basis specific to the WIC agencies. Furthermore, simplifying the wording will provide better understanding to the participants. (c) “The curriculum was appropriate for its target audience.” Expert “C” further indicated that the lessons had too high of a literacy level which have since been addressed. In an effort to limit confusion, the target audience must be provided with curriculum easy to understand. (d) “The material used in the curriculum was cited and referenced properly.” Expert “C” indicated that there needed to be proper citations, which have since been added. Sources must be cited to validate the material and limit questionable statements.

As mentioned above, a key criticism from expert “C” was the comment regarding practical difficulty presenting the lessons during 5 sessions, as it may be unrealistic for participants to attend five different 15-minute lessons. Most WIC classes average between 20-60 minutes and encompass all the information during one class. Therefore, it may be appropriate for this WIC agency to present the content of the five lessons during one session. To allow for this, it may be necessary to modify the lessons and or activities to allow for this condensed presentation of the material. All of the edits and recommendations, except for making the lesson into one instead of five, were made and incorporated into the new curriculum (Appendix P, Q, R, S, T).
Future Studies

Omega-3 fatty acids are getting more recognition with respect to beneficial components in research, one factor being cardiovascular disease. There is need for additional exploration on the matter (i.e. it would be beneficial to find out how the consumption of each omega-3 fatty acid rich food influences the breast milk and how bioavailable it is for the infant). Additionally, there is a need for recognition in genetics. Genetics, primarily the FAD2 gene, reports decreased enzymes converting ALA to EPA (and eventually DHA). The population with the gene FAD2 reports an increased need for algae and fish source omega-3 fatty acids. Furthermore, it would be beneficial to explore how omega-3 fatty acid intake effects the different trimesters throughout the pregnancy period and it’s correlation to health outcomes for the infant.

While there needs to be a strong push for increased omega-3 fatty acid consumption in the United States, there are also some issues with some foods that are high in this essential PUFA. Fish and shellfish are considered to be a major source for omega-3s, however they are also a major source of methylmercury (MeHg); a neurotoxin known to negatively target fetal brain development as well as many other negative side effects (Mahaffey et al., 2011). Only 6% of women of childbearing age exceed the U.S. Environmental Protection Agency’s reference dose (RfD) for MeHg (Mahaffey et al., 2011). The purpose for consuming seafood, regardless of the MeHg content, is because of the high levels of omega-3 fatty acids. Fish and shellfish cannot synthesize omega-3s, however, their main food source, algae, can synthesize these essential PUFA’s (Mahaffey et al., 2011). Due to their high consumption of algae, fish and shellfish are good sources of essential omega-3s DHA and EPA. The negative effects of mercury may be offset with
the consumption of selenium because selenium may bind to mercury and prevent mercury’s adverse reactions (Ralston, 2009; Raymond & Ralston, 2004). In future studies, it may be beneficial to explore the impact of mercury and selenium supplementation possibly decreasing the mercury in adults, and potentially in pregnant or breastfeeding women.

Premature infants are at heightened risk of developing a DHA deficiency. DHA in the last trimester of pregnancy is estimated to be about 60 milligrams per day, dependent on diet (Marc et al., 2011). As the infant is premature, this phase is skipped. An additional reason that premature infants are at higher risk for deficiency is that they have inadequate fat reserves and the conversion of DHA from ALA is very low (Marc et al., 2011). A study completed on premature infants where their mother’s diet was fortified with 1,200 milligrams of DHA (which raised the breast milk DHA) increased DHA levels in premature infants compared to the control group (Marc et al., 2011). Further research indicated that DHA levels through supplementation are directly correlated to DHA in breast milk and non-premature infants' plasma levels (Jensen, Maude, Anderson, & Heird, 2000). There could be potential in future studies to explore how to prevent deficiency of omega-3 fatty acids in premature infants.

Nutrition-based education programs such as what was presented in this project has the potential for decreasing the prevalence of omega-3 deficiency in pregnant, and/or breastfeed women. This reduction of omega-3 deficiency may positively affect the infant’s intellectual development, immune system, and overall development (Lattka et al., 2011; McColl, Dhillon, & Howard, 2012; Morse, 2012; Quinn & Kuzawa, 2012). These types of programs may also have an impact on decreasing allergic diseases, poor growth,
cardiovascular diseases, mental illness, stress, and inflammation (Luxwolda et al., 2011; Quinn & Kuzawa, 2012). These programs may further influence the individual’s environment, such as social settings (Bronfenbrenner, 1979).

**Limitations**

The primary limitation of this project is that the nutrition education curriculum was not yet presented to multiple audiences and lacked evaluation. Without a pre and post survey (or another type of assessment), the project’s efficacy cannot be determined. It may also be beneficial to compare the curriculum developed for this project with other omega-3 fatty acid curriculums specific to this population. Furthermore, this omega-3 nutrition-based education curriculum was intended for the Los Angeles, California, WIC offices. Given the aforementioned, this project cannot be generalizable. The lessons are only in English currently, which will be a limiting factor since participants that are only Spanish speaking will not be able to receive this education. According to United States Census Bureau, Los Angeles County is 48.3% Hispanic or Latino (2015). A nutrition-based education curriculum on the topic of omega-3 fatty acids is needed specifically for pregnant and/or breastfeeding women, and this may contribute to existing behavior-based interventions available.

**Implications**

If the curriculum was combined into one lesson with the activities implemented, this curriculum could have potential to be a great addition to the classes given at WIC. If implemented among WIC participants, the development of this curriculum may increase knowledge of omega-3 fatty acids and promote change in behavior related to the intake of omega-3 fatty acid-rich foods among pregnant and breastfeeding women. If beneficial,
this curriculum may be used as a tool to reduce omega-3 fatty acid deficiency and related negative effects. With further development, this curriculum could also be used in other communities, thus potentially benefitting society.

**Conclusions**

Many factors contribute to this unhealthy dietary pattern. The purpose of this graduate project was to develop a nutrition-based education curriculum that provides participants with knowledge regarding omega-3 fatty acids and omega-3 fatty acid-rich foods and in doing so, also increase awareness of the health benefits of adequate omega-3 fatty acid intake. After incorporating the changes from the expert panel, with the exception of compressing the five lessons into one lesson, this curriculum may have the ability to change the perception of omega-3 fatty acid through the education provided if used. The goal is to change participants’ eating behaviors by way of reducing omega-3 fatty acid deficiency in WIC participants that are pregnant and/or breastfeeding. In the future, the focus should be on the implications from presenting the curriculum and making further changes to the curriculum.
REFERENCES


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from fish consumption and polyunsaturated fatty acids: Association with child
development at 20 month of age in an observational study in the Republic of
doi:10.3945/ajcn.114.100503

Omega-3 for baby and me: Material development for a WIC intervention to
increase DHA intake during pregnancy. *Maternal and Child Health Journal, 9*(2)
189-197. doi:10.1007/s10995-005-4908-0


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APPENDIX A

Omega-3 Fatty Acid Lesson Plan 1

Lesson: Introduction of Dietary Fats

Grade Level: Adults with at least middle school education

Content Area: This lesson will discuss different dietary fats, going into specific details about omega-3 fatty acids.

Objective:
• Participants will be able to state 1 good fat and 1 bad fat
• Participants will understand why trans fats are bad for the human body
• Participants will be able to discuss what an omega-3 fatty acid is.

Materials: PowerPoint and Questionnaire

Time: 15-20 minutes

Introduction:
Ask participants what they think are good about fats, specifically in the human body.
Fats are essential for the brain, organ function, every cell in the body, skin, and many other functions in the body.

Procedure:
There are 3 essential points to review when discussing fats in general
1. What are the different types of fats?
   a. Good (healthier) fats-Can improve blood cholesterol levels, benefit insulin levels, beneficial for blood sugar control, helping decrease type 2 diabetes, heart healthy, decrease coronary artery disease, decrease blood pressure
   b. Bad (less healthy) fats-Can increase total blood cholesterol, cardiovascular disease, type 2 diabetes
   c. Saturated vs. Unsaturated
      i. Saturated-physical characteristics include a single bond, extended shelf life, and sold at room temperature
      1. Sources include animal fats, butter, whole milk, meat, peanut butter, margarine, cheese, fried foods
      ii. Unsaturated fats- at least 1 double bond, spoil more readily, and liquid at room temperature
      1. Plant-based, Avocado, olive oil, fish, walnuts, flax seeds, cashews, beans, eggs, broccoli, oatmeal
   d. Trans Fat- “the worst fat” due to risk of raising bad cholesterol and lowering good cholesterol. Trace amounts exist in animal products; most trans fats in our diets are formed by hydrogenated oil. The benefit of hydrogenated oil is that it extends shelf life of foods.
e. Essential Fats
   i. Our body does not have the ability to make this unless it is through the diet. Examples include omega-3s and omega-6s

2. Health benefits of dietary fat

3. Introduction of omega-3 fatty acids
   a. Three fats considered Omega-3 are ALA, EPA, and DHA. Benefits of omega-3s include decreased heart attacks, stroke, and arthritis, decreased triglycerides and LDL, increased HDL, essential for eye function and visual sharpness, decreases eye disease. Local hormone production for the regulation of blood pressure and immune/inflammatory response. Cancer prevention and prevents weight loss in chemotherapy patients. Decreases depression, anxiety and stress (60% of the brain is fat). Memory enhancement in healthy individuals.
   b. Ratio of omega-3 fatty acids to omega-6
      i. Supposed to have a (4) omega-6 to (1) omega-3 ratio.

Closure/Conclusion:
Not all fats are bad, and some have really healthy and important functions in the body.

Next Lesson: Importance of Omega-3 Fatty Acids for Pregnancy and Breastfeeding Women

Extended Activities:
Omega-3 Fatty Acid Questionnaire:
Each participant will be given a questionnaire to complete, 1 page front and back, to determine omega-3 fatty acid consumption.

References
- Papanikolaou, Y. (2014, April 2). U.S. adults are not meeting recommended levels for fish and omega-3 fatty acid intake: Results of an analysis using observational data from


Lesson: Importance of Omega-3 Fatty Acids for Pregnancy and Breastfeeding Women

Grade Level: Adults with at least middle school education

Content Area: This lesson will discuss the importance of omega-3 fatty acids, more directly correlated to pregnancy, breastfeeding, and infant health.

Objective:
- Participants will verbalize one benefit of omega-3 fatty acids to infants, pregnant women, and breastfeeding women.
- Participants will be able to identify one population that is at higher risk for omega-3 fatty acid deficiency.
- Participants will be able to list 3 countries that report the lowest levels of DHA.

Materials: Power Point and Crossword Puzzle

Time: 15-20 minutes

Introduction:
Ask participants if they think omega-3 fatty acids are important during pregnancy and why. Omega-3 fatty acids play an important role in pregnancy. They are important because they are directly transferred to the developing infant. Adequate omega-3 fatty acids during pregnancy can impact the infant’s brain development; primarily cognitive development, language development, and hand/eye coordination.

Procedure:
There are 3 essential points to review when discussing omega-3 fatty acids importance on pregnancy, breastfeeding, and infant development:
4. Why are omega-3 fatty acids important to infants?
   a. Higher IQ scores, important for normal function of brain, eyes, liver, kidneys and other organs, improved hand/eye coordination, decreased food allergies, asthma, eczema, language development, being able to sit up without support at an earlier age, and able to grab objects at a younger age.
5. Why are omega-3 fatty acids important to pregnant women?
   a. Decrease stress, depression, anxiety, enhance memory, reduce low birth weights by 35%, prevent very early pre-term (by 50%), prevent slow development in infants (by 64%), decreased low birth weight, fetal/infant death, and intensive care admissions.
6. Why are omega-3 fatty acids important to breastfeeding women?
   a. Supplementation of omega-3 fatty acids help improve lactation, decrease stress, depression and anxiety, decreases inflammation and blood pressure which can potentially aid with engorgement and let down of breastmilk, help enhance memory, 7. Omega-3’s and consumption around the world
a. United states has one of the lowest in the world, only countries equal or lower were Pakistan, Canada, and Rural South Africa
b. Highest levels were Japan, Canadian Arctic, and Dominican Republic
8. The heart foundation recommends that everyone should consume 500 mg of omega-3s every day or eating 2-3 servings of fish weekly.
9. Who is at risk of deficiency
   a. Vegetarians, low-socioeconomic families, distaste or inadequate seafood consumption, refusal or unable to take fish oil supplements.

Closure/Conclusion:
Fats play a major role in conception throughout breastfeeding both to mother and infant.

Next Lesson: Omega-3 foods and barriers

Extended Activities:
Omega-3 Fatty Acid Circle activity:
   Each participant will be given a crossword puzzle to complete that contains information from the slides.

References:
APPENDIX C

Omega-3 Fatty Acid Lesson Plan 3

Lesson: Omega-3 foods and barriers

Grade Level: Adults with at least middle school education

Content Area: This lesson will discuss what foods contain omega-3 fatty acids and who is at risk for being deficient.

Objective:

• Participants will be able to identify omega-3 fatty acid foods.
• Participants will be able to verbalize 1 individual that is at higher risk of being deficient in omega-3s.
• Participants will be able to state the danger of fish and shellfish.

Materials: Power Point and Circle Handout

Time: 15-20 minutes

Introduction:
Ask participants what their favorite omega-3 fatty acid foods are.
Pass out handout of different foods that contain omega-3 fatty acids. Review which foods are participants’ favorite of the two lists.

Procedure:
There are 3 essential points to review omega-3 fatty acids and the barriers associated with decreased consumption.
10. Review seafood based and non-seafood based omega-3 fatty acid foods.
   a. Cod, tuna, shrimp, clams, scallops, Pollock, oysters, mussels, trout, sardines, herring, salmon.
   b. Flaxseeds, hempseeds, cloves, oregano, marjoram, tarragon, mint, basil, sage, rosemary, algal oil, radish seeds, chili powder, sweet red peppers, yellow onion, chia seeds, walnuts, almonds, pecans, soy beans & tofu, grape leaves, seaweed/spirulina, leeks, fortified eggs, yogurt, beans (pinto, red & navy).
11. Dangers linked to omega-3 fatty acids and seafood.
   a. Mercury can cause damage to the nervous system. Six percent of women that are childbearing age exceed USA environmental protection agency’s reference dose for mercury.
12. Who is at risk for deficiency?
   a. Vegetarians, low socioeconomic families, distaste or inadequate consumption, refusal or unable to take fish oil supplements, lack of educations.

Closure/Conclusion:
It is important to focus on foods that are high in omega-3 fatty acids, yet low in mercury to obtain the benefits without the risks.

Next Lesson: Meal planning to increase omega-3s

Extended Activities:
Omega-3 Fatty Acid Circle activity:
Each participant will be given circle handout, where they will circle foods they believe are high in omega-3 fatty acids. Once this is completed we will review the answers as a group.

Reference:
Lesson: Meal planning to increase omega-3s

Grade Level: Adults with at least middle school education.

Content Area: This lesson will review recipes that contain omega-3 fatty acids that can be made for different meals throughout the day.

Objective:
- Participants will be able to determine which omega-3 fatty acid recipe is highest in omega-3s.
- Participants will be able to verbalize which recipe they are most likely to try at home.
- Participants will be able to state which recipe they are least likely to attempt.

Materials: Power Point and Recipe Handout

Time: 15-20 minutes

Introduction:
Ask participants what they enjoy cooking at home.
Pass out recipes and review different recipes in the packet, finding out which they are most likely to try and which they are least likely to try.

Procedure:
There are 2 essential points to review omega-3 fatty acids and the barriers associated with decreased consumption.

13. Review heart foundations recommendations for omega-3 fatty acids and what foods contain fatty acids.
14. Review breakfast, lunch, and dinner recipes, including how much omega-3s are obtained per serving.

Closure/Conclusion:
Trying new foods can be exciting, but sometimes the best way to sneak omega-3 fatty acids into your diet is by adding the food rich in this nutrient to your already favorite meals. Try all these recipes, and bring your favorite one to the last class.

Next Lesson: Overall review and potluck

Extended Activities:
Omega-3 Fatty Acid Circle activity:
Review recipes, rating the favorite recipes, and recipes that are less likely to be liked by the household.
Reference:
- All Recipes are original recipes from Mor Levy, R.D.N.
APPENDIX E

Omega-3 Fatty Acid Lesson Plan 5

Lesson: Overall review and potluck

Grade Level: Adults with at least middle school education.

Content Area: This lesson will review lessons 1-4, and highlight the main points; we will also taste omega-3 rich foods/recipes.

Objective:
• Participants will be able to consume more omega-3 fatty acid rich foods, compared to the beginning lesson.
• Participants will be able to verbalize what are 3 benefits of omega-3 fatty acids.
• Participants will be able to state 2 foods they consume that have omega-3 fatty acids.

Materials: Power Point and Questionnaire

Time: 15-20 minutes

Introduction:
Ask participants which recipes they have tried to make since last class
Encourage participants to discuss what recipes they tried and what the family’s reactions were to these new foods.

Procedure:
There are 5 essential points to review all the past lessons that were discussed
15. Healthy vs. Harmful fats.
16. Importance of omega-3 fatty acids in general and to infants/newborns.
17. Who is at risk for deficiency?
18. Omega-3 fatty acid rich foods.
19. Different recipes.

Closure/Conclusion:
Thank everyone for being a part of the 5 lessons, and enjoy the potluck of foods everyone brought.

Extended Activities:
Omega-3 Fatty Acid Questionnaire:
   Pass out the same questionnaire to all participants that they took from lesson 1, once completed, start the potluck.

Reference:
• American Heart Association. (2014). Fish and omega-3 fatty acids. Retrieved from http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Fish-and-Omega-3-Fatty-Acids_UCM_303248_Article.jsp
• Luxwolda, M. F., Kuipers, R. S., Sango, W. S., Kwesigabo, G., Dijick-Brouwer, D. A. J., & Muskiet, F. A. J. (2012). A maternal erythrocyte dha content of approximately 6g% is the dha status at which intrauterine dha biomagnifications turn into bioattenuation and postnatal infant dha equilibrium is reached. European Journal of Nutrition, 2012(51), 665-675.
APPENDIX F
Expert Review Form A

July 2015

Formative Evaluation Survey

Part 1: General Information

Please mark or fill in the appropriate response.

1. Please indicate your appropriate age range:
   □ <20 yrs
   □ 20-29 yrs
   □ 30-39 yrs
   □X 40-49 yrs
   □ 50-59 yrs
   □ 60-69 yrs
   □ >70 yrs

2. Please indicate your gender:
   □ Male
   □X Female

3. Please indicate your ethnicity:
   □X White, Non Hispanic
   □ Black, Non Hispanic
   □ Hispanic/Latino
   □ Asian/Pacific Islander
   □ American Indian
   □ Other:

4. Which most appropriate describes your area(s) of expertise:
   □ Education
   □ Physical Activity
   □ Curriculum
   □ XNutrition
   □ Adolescents
   □ Health
   □ XOther: MCH Nutrition, Pediatric nutrition

5. Please indicate your highest level of education:
   □ MA/MS
   □ XPhD
   □ EdD
   □ DrPH
   □ Other:

6. Please indicate your current position of employment:
   □ Junior High School Teacher
   □ High School Teacher
   □ XUniversity/College Professor
   □ Public Health Advocate
   □ Other:

7. Do you have any experience working with pregnant and/or breastfeeding women?
   □X Yes
   □ No
**Part II: Evaluation of curriculum**

Instructions: Using a scale from 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree, please rate the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>1= Strongly Disagree</th>
<th>2= Disagree</th>
<th>3= Not sure</th>
<th>4= Agree</th>
<th>5= Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The curriculum topic was researched and displayed well.</td>
<td></td>
<td></td>
<td>![X]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The curriculum was clear and concise.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
<tr>
<td>The curriculum content was presented in an effective manner.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
<tr>
<td>The curriculum was appropriate for its target audience.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
<tr>
<td>The curriculum was easy to understand.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
<tr>
<td>The Student Handbook and other lesson handouts supported the curriculum appropriately.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
<tr>
<td>The material used in the curriculum was cited and referenced properly.</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
<td>![X]</td>
</tr>
</tbody>
</table>

Would you recommend the use of this curriculum?

- ![X] Yes
- ![X] No

Additional comments, criticisms, or recommendations:

Information presented is useful for a lay audience. However, there are very few citations for the amount of information presented, which brings into question the actual sources and where the information presented actually came from. I was able to identify two sources of information and one of them is the Mayo clinic, which I do not count as a viable scientific reference – therefore, I would have my doubts with respect to presenting this curriculum to any audience. For example, are the recipes original creations? If not, there should be a source cited from where they originated. At the very least, I think a proper list of references used and in which lessons they can be attributed should be developed and completed.
APPENDIX G
Expert Review Form B

July 2015

Formative Evaluation Survey

Part 1: General Information

Please mark or fill in the appropriate response.

1. Please indicate your appropriate age range:
   - □ <20 yrs
   - □ 20-29 yrs
   - □ 30-39 yrs
   - □ 40-49 yrs
   - □ 50-59 yrs
   - □ 60-69 yrs
   - □ >70 yrs

2. Please indicate your gender:
   - □ Male
   - □ Female

3. Please indicate your ethnicity:
   - □ White, Non Hispanic
   - □ Black, Non Hispanic
   - □ Hispanic/Latino
   - □ Asian/Pacific Islander
   - □ American Indian
   - □ Other:

4. Which most appropriate describes your area(s) of expertise:
   - □ Education
   - □ Physical Activity
   - □ Curriculum
   - □ Nutrition
   - □ Adolescents
   - □ Health
   - □ Other:

5. Please indicate your highest level of education:
   - □ MA/MS
   - □ PhD
   - □ EdD
   - □ DrPH
   - □ Other:

6. Please indicate your current position of employment:
   - □ Junior High School Teacher
   - □ High School Teacher
   - □ University/College Professor
   - □ Public Health Advocate
   - □ Other:

7. Do you have any experience working with pregnant and/or breastfeeding women?
   - □ Yes
   - □ No
Part II: Evaluation of curriculum

Instructions: Using a scale from 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree, please rate the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>1= Strongly Disagree</th>
<th>2= Disagree</th>
<th>3= Not sure</th>
<th>4= Agree</th>
<th>5= Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The curriculum topic was researched and displayed well.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The curriculum was clear and concise.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The curriculum content was presented in an effective manner.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The curriculum was appropriate for its target audience.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The curriculum was easy to understand.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The Student Handbook and other lesson handouts supported the curriculum appropriately.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
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<td>The material used in the curriculum was cited and referenced properly.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Would you recommend the use of this curriculum?

X Yes □ No

Additional comments, criticisms, or recommendations:

Lesson 1: Font color in PowerPoint is inconsistent (some is black and some is grey). Also, slide number 19 shows how Americans consume between a 10:1 and 30:1 ratio of omega 3:omega 6 when it should be 4:1. So my question to you is this: if I was a participant and I saw this, I would think I need to consumer more omega 6’s, and then wonder why I am attending lessons on consuming more omega 3’s. Does that make sense? May you can add something to this slide (or the lecture notes) about what this means, it’s importance, and how it fits into your curriculum. **Questionnaire:** See attached with comments.

Lesson 2: PowerPoint: slide 11 – The third bullet point doesn’t make sense to me – can it be rephrased? Again the font is inconsistent. Some of the headings are grey and some black. **Crossword:** 5 down – was that discussed in the lecture/PP? I don’t recall seeing it.

Lesson 3: PowerPoint: great! This one was my favorite so far! **Content:** You briefly discuss mercury however there is research to support selenium inhibiting mercury poisoning. Here is a link to one review paper from 2004: [http://darc.cms.udel.edu/SGSFR/Mercury%20selenium%20interactions%20and%20health%20implications.pdf](http://darc.cms.udel.edu/SGSFR/Mercury%20selenium%20interactions%20and%20health%20implications.pdf) and another paper from 2009: [http://link.springer.com/article/10.1007/s10393-008-0202-0](http://link.springer.com/article/10.1007/s10393-008-0202-0). Perhaps it’s worth mentioning?
Lesson 4: PowerPoint: yum!! Looks good.

Lesson 5: Looks good too!
APPENDIX H

Expert Review Form C

July 2015

Formative Evaluation Survey

Part 1: General Information

Please mark or fill in the appropriate response.

1. Please indicate your appropriate age range:
   - □ <20 yrs
   - □ 20-29 yrs
   - □ 30-39 yrs
   - □ 40-49 yrs
   - □ 50-59 yrs
   - □ 60-69 yrs
   - □ >70 yrs

2. Please indicate your gender:
   - □ Male
   - □ Female

3. Please indicate your ethnicity:
   - □ White, Non Hispanic
   - □ Black, Non Hispanic
   - □ Hispanic/Latino
   - □ Asian/Pacific Islander
   - □ American Indian
   - □ Other:

4. Which most appropriate describes your area(s) of expertise:
   - □ Education
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   - □ Nutrition
   - □ Adolescents
   - □ Health
   - □ Other:

5. Please indicate your highest level of education:
   - □ MA/MS
   - □ PhD
   - □ EdD
   - □ DrPH
   - □ Other:

6. Please indicate your current position of employment:
   - □ Junior High School Teacher
   - □ High School Teacher
   - □ University/College Professor
   - □ Public Health Advocate
   - □ Other: Director of WIC Program

7. Do you have any experience working with pregnant and/or breastfeeding women?
   - □ Yes
   - □ No
**Part II: Evaluation of curriculum**

Instructions: Using a scale from 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree, please rate the following statements:

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</table>

Would you recommend the use of this curriculum?

☐ Yes [for nutrition educators]

☐ No [WIC clients]

Additional comments, criticisms, or recommendations:

*see attached.*
Feedback for Mor:

- This content of this curriculum is very thorough. I feel that the appropriate target audience for these lesson plans are for nutrition educators, i.e. WIC staff, rather than for WIC participants or other lay population.

- I do not feel that it is appropriate for WIC clients, for the following reasons:
  - Too lengthy
  - Written at a high literacy level
  - Too technical

- Suggestions for improvement:
  - Simplify the language. Use fewer technical words.
  - Cite more references.
  - Use more pictures
  - Match the lesson plan and slides better.
  - Include an overview at the start of each class. For subsequent classes, do a review of the previous class. (Some of the classes had this, but not all).
  - Condense information to one class, rather than 5.
  - Make the lesson more interactive.
APPENDIX I
Lesson Plan Outline

1. Introduction of Dietary Fat
   a. Different types of fats
   b. Health benefits of dietary fat
   c. Introduction of omega-3 fatty acids
   d. Activity
      i. Determining baseline omega-3 fatty acid intake [Omega-3 Questionnaire]

20. Importance of Omega-3 Fatty Acids for Pregnant and Breastfeeding Women
   a. Review of omega-3 fatty acid health benefits
   b. Specific role of omega-3 fatty acids
   c. Populations that are at high risk for omega-3 deficiency
   d. Handout: all the benefits of omega-3 fatty acids while pregnancy/breastfeeding
   e. Activity
      i. Crossword puzzle with questions and answers about the benefits

21. Overview of omega-3 rich foods & overcoming barriers to adequate intake
   a. Discuss foods that are high in omega-3 fatty acids (seafood and non-seafood options)
   b. Seafood that are high in mercury and why avoid them
   c. Discuss barriers that may prevent adequate intake and strategies for overcoming those barriers
   d. Activity: circle which foods have omega-3’s
      i. Handout: food list of items that are high in omega-3’s

22. Meal planning for optimal intake of omega-3 fatty acids
   a. Review the recommended amount
   b. Give recipes for omega-3 fatty acid rich foods
   c. Handout: recipes

23. Review summary of main points from lessons 1-4 and host a pot luck where the target population provide foods high in omega-3 fatty acids?
   a. Do a post-test [repeat survey from lesson 1] to evaluate intake after lessons 1-4
APPENDIX J

Omega-3 Questionnaire

1. What is your current age? _______________

2. How many times have you been pregnant? _____  How many births? ______

3. How was your infant born? □ Vaginal □ C-Section Twins or Triplets? □
               Yes □ No

4. When was your baby born (Month/Year)? __________________

5. Circle your baby’s gestational age in weeks 36 or less 37-38 39-40 41+

6. What was baby’s birth weight? _______________ (lbs/oz) Birth length? ______(in)

7. Are you employed or going to school? □ Yes □ No □ Planning to Start

8. What is the highest degree or level of school you have completed?
               □ No schooling completed □ Middle School □ Some High School
               □ Completed High School □ Some college □ Associates degree
               □ Bachelor’s degree □ Master’s Degree □ Other _______________

9. Marital status: □ Single (never married) □ Married □ Divorced □ Other _____________

10. Are you: □ Hispanic/Latino □ American Indian/Native American □ Asian/Pacific Islander
                □ Black/African American □ Caucasian/White □ Other _______________

11. Do you have any food restrictions or allergies? □ No □ Yes  If yes, what? _____________

12. Are you currently breastfeeding your baby? □ Yes □ No
                If yes, how many times in 24 hours (day and night) does your baby breastfeed? ______

13. Have you ever offered your baby formula? □ Yes □ No
                When was the last time you formula fed your baby? _______________
                How many ounces in 24 hours (day and night) does your baby get formula? __________

14. Have you ever breastfed prior to this child? □ Yes □ No  If yes, for how long? ______

15. Do you have: □ Diabetes (High Blood Sugar) □ High Blood Pressure □ Anemia
                □ Mental Health Issues □ Other disease □ None

16. When was the last time you used drugs (non-prescribed)? _______ Month/Year □ Never
                Are you currently taking any prescribed drugs? □ Yes □ No  If Yes, What? ______
                When was the last time you smoked a cigarette? _______________ Month/Year □ Never
                When was the last time you drank alcohol? _______________ Month/Year □ Never

17. How many times have you eaten fish or shellfish in the past week?
                □ 0 times □ 1-3 times □ More than 3 times

18. Over the past 6 months, about how often have you eaten fish or shellfish in any form?
IF NEVER, SKIP TO QUESTION 21. □ Never □ Less than 1 time each month
□ 1 time each month □ 2-3 times each month □ 1 time each week □ 2 times each week
□ 3-4 times each week □ 5-6 times each week □ 1 time a day □ 2 or more times a day

19. Each time you ate fish or shellfish, how much did you eat?
□ Less than 2 ounces or less than one fillet or less than 4 pieces of sushi
□ 2 to 7 ounces or about 1 fillet or 4-14 pieces of sushi
□ More than 7 ounces or more than 1 fillet or more than 14 pieces of sushi

20. Please check off the types of fish or shellfish you eat: (Check off as many as are appropriate for you).
□ Bass □ Bluefish □ Catfish □ Clams □ Cod □ Crab □ Flounder □ Haddock
□ Halibut □ Herring □ Kingfish □ Lobster □ Mackerel □ Mahi Mahi □ Mussels
□ Oysters □ Salmon □ Sardines □ Scallops □ Sea Trout □ Shark □ Shrimp
□ Skate □ Snapper □ Sole □ Swordfish □ Tilapia □ Tilefish □ Trout
(freshwater) □ Tuna □ Turbot □ Whitefish □ Whiting □ Other ______________

21. In the past 6 months, about how often did you eat walnuts? If NEVER, Skip to Question 23
□ Never □ Less than 1 time each month □ 1 time each month
□ 2-3 times each month □ 1 time each week □ 2 times each week
□ 3-4 times each week □ 5-6 times each week □ 1 time a day □ 2 or more times a day

22. Each time you ate walnuts, how much did you eat?
□ Less than ¼ cup □ ¼ to ½ cup □ more than ½ cup

23. In the past 6 months, about how often did you eat flaxseeds? If NEVER, Skip to Question 27
□ Never □ Less than 1 time each month □ 1 time each month
□ 2-3 times each month □ 1 time each week □ 2 times each week
□ 3-4 times each week □ 5-6 times each week □ 1 time a day □ 2 or more times a day

24. Each time you ate flaxseeds, how much did you eat?
□ Less than a teaspoon □ 1-2 teaspoons □ 2 teaspoons □ 3 teaspoons (1 tablespoon) □ More than a tablespoon

25. In the past 6 months, about how often did you consume flaxseed oil? If NEVER, Skip to 27
□ Never □ Less than 1 time each month □ 1 time each month □ 2-3 times each month
□ 1 time each week □ 2 times each week □ 3-4 times each week □ 5-6 times each week
□ 1 time a day □ 2 or more times a day

26. Each time you consumed flaxseed oil, how much did you have?
□ Less than a teaspoon □ 1-2 teaspoons □ 2 teaspoons □ 3 teaspoons (1 tablespoon) □ More than a tablespoon

27. In the past 6 months, about how often did you consume cod liver oil? If NEVER, Skip to Question 29
□ Never □ Less than 1 time each month □ 1 time each month
□ 2-3 times each month □ 1 time each week □ 2 times each week
□ 3-4 times each week □ 5-6 times each week □ 1 time a day □ 2 or more times a day

28. Each time you consumed cod liver oil, how much did you have?
□ Less than a teaspoon □ 1-2 teaspoons □ 2 teaspoons □ 3 teaspoons (1 tablespoon) □ More than a tablespoon

29. In the past 6 months, have you used an Omega 3 fatty acid (DHA) or fish oil supplement at least once a week?
□ NO (You are finished with the questionnaire)
☐ YES – What type of Omega 3 fatty acids (DHA) or fish oil supplement do you take:
________________________

30. Is the Omega 3 fatty acid (DHA) or fish oil supplement in pill or capsule form?
☐ NO (Skip to next Question)
☐ YES- How many did you take:
☐ 1 pill/capsule each week ☐ 2 pills/capsules each week
☐ 3-4 pills/capsules each week ☐ 5-6 pills/capsules each week
☐ 1 pill/capsule each day ☐ 2 pills/capsules each day
☐ 3-4 pills/capsules each day ☐ 5 or more pills/capsules each day

31. Is the Omega 3 fatty acids (DHA) or fish oil supplement (besides cod liver oil) in liquid form?
☐ NO
☐ YES- How many did you take?
☐ Less than 1 tablespoon each week ☐ 1 tablespoon each week
☐ 2 tablespoons each week ☐ 3-4 tablespoons each week
☐ 5-6 tablespoons each week ☐ 1 tablespoon each day
☐ 2 tablespoons each day ☐ 3-4 tablespoons each day
☐ 5 or more tablespoons each day

32. Please write down the dosage of Omega 3 fatty acids or fish oil supplement:

**Dosage:**
☐ Pills or Capsules: ____________ Mg Per Pill or Capsule
☐ Liquid: _______________ Mg Per Tablespoon
☐ Don’t know dosage
ACROSS
1 Consuming omega-3s while breastfeeding can decrease _______, depression, and anxiety.
4 The Heart Foundation recommends that everyone consume 500 mg of omega-3s every day or eat how many servings of fish every week?
6 Infants need omega-3s for optimal brain growth, development, and ____________.
9 What is the plant version of omega-3s? (Abbreviation)
11 Omega-3s help enhance memory and could benefit moms with _________ _________.
13 What is a harmful fat that is man made?
14 DHA during pregnancy and breastfeeding is completely determined by what?
15 What is a good fat that only has one double bond?
1. _______ percent of the brain is fat.
2. Omega-3s decrease heart attacks, strokes and __________.
3. Who is at risk for being omega-3 deficient?
4. How many hours does it take for the omega-3s to affect the breastmilk?
5. You need a ratio of _______ to one of omega-6 to omega-3.
6. Omega-3s are thought to decrease what skin allergy?
7. Intake of DHA in the United States is one of the __________ in the world.
8. Infants with adequate omega-3s have ________ IQ scores.
Suggested benefits of higher omega-3 intake among pregnant and breastfeeding women

1. Higher IQ scores
2. Improved hand eye coordination in infants
3. Enhanced brain growth, development and function of infant enhanced
4. Omega-3’s during infancy and childhood linked to decrease in the development of food allergies, asthma and eczema (skin allergies)
5. Reduced risk of low birth weights
6. Reduced risk of very early pre-term
7. Reduced risk slow development in infants
8. Reduced risk low birth weight, fetal/infant death, and intensive care admissions
9. Improved language development, being able to sit up without support earlier and grabbing objects at a younger age.
APPENDIX M

Handout 2

**Omega-3 Foods**

<table>
<thead>
<tr>
<th>Seafood Base</th>
<th>EPA + DHA mg/100g</th>
<th>Mercury mg/1000g fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cod</td>
<td>172</td>
<td>0.06-0.11</td>
</tr>
<tr>
<td>Light Tuna Canned</td>
<td>281</td>
<td>0.11-0.12</td>
</tr>
<tr>
<td>Shrimp</td>
<td>347</td>
<td>0.03-0.04</td>
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<tr>
<td>Clams</td>
<td>396</td>
<td>0.01-0.06</td>
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<td>Scallop</td>
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<td>Pollock</td>
<td>570</td>
<td>0.02-0.06</td>
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<tr>
<td>Oysters</td>
<td>740</td>
<td>0.01-0.07</td>
</tr>
<tr>
<td>Mussels</td>
<td>866</td>
<td>0.03-0.08</td>
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<tr>
<td>Trout</td>
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<tr>
<td>*Sardines</td>
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<td>0.02-0.03</td>
</tr>
<tr>
<td>*Herring</td>
<td>2,218</td>
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</tr>
<tr>
<td>*Salmon</td>
<td>2,586</td>
<td>0.04-0.13</td>
</tr>
</tbody>
</table>

**Plant Based**

- Chia Seeds
- Walnuts, Almonds & Pecans
- Soy Beans & Tofu
- Grape Leaves
- Seaweed/Spirulina
- Leeks
- Fortified Eggs and Yogurt
- Beans (Pinto, Red & Navy)
- Flaxseeds
- Hempseeds
- Cloves, Oregano, Marjoram, Tarragon, Mint, Basil, Sage & Rosemary
- Algal Oil
- Radish Seeds
- Chili Powder
APPENDIX N

Omega-3 Activity
Please circle each food item that you believe is an omega-3-rich food.
APPENDIX O

Omega-3 Recipes

Omega-3 Bar

Ingredients

1/2 cup medjool dates
1/2 cup water
3/4 cup walnuts
1/2 cup hemp seeds
2 tablespoons chia seeds
2 tablespoons ground flaxseeds
1 cup ground oats
3.5 tablespoons unsweetened cocoa powder
1/4 cup semi-sweet chocolate chips
2 tablespoons coconut oil
1/2 cup shredded coconut
1/3 cup (83ml) of almond butter

Directions:

• Preheat your oven to 375°
• In a small pot, make date puree with water and dates
• In a medium bowl combine all the ingredients: date puree, walnuts, hemp seeds, chia seeds, flaxseeds, cocoa powder, oats, chocolate chips, coconut oil, shredded coconut and almond butter
• Mix until blended well and put in an oven dish. Spread mix and press gently to make it even
• Cook in the oven for about 25 minutes or until golden
• When you remove it from the oven, let it cool completely before you take it out or you will end up with granola

1 bar is 500 mg Omega-3’s
Omega-3 Chocolate ‘Milk’ Smoothie

Ingredients:

1-2 tablespoons Flaxseeds
1-2 tablespoons Chia seeds
1 teaspoon Hempseeds
¼ cup Walnuts
2-3 cups Water (depending on how thick or thin you like it)
1 tablespoon Cocoa Nibs
1 tablespoon Cocoa Powder
5 Dates (optional, depending on how sweet you like it)
3 dashes of Cinnamon
1 Banana
1 cup Kale

Directions:

• Put all the ingredients in a good quality blender. Add only 1 cup of water at first, and then slowly add ½ cup until it is the consistency you desire. You can also add a cup of ice instead of one cup of water if you like it chilled. Enjoy!
• Make a large pitcher and save in the fridge (gets better the next day!)

1 cup is 760 mg Omega-3’s
Creamy Chia Seed Pudding with Mangos

Ingredients

½ cup of pureed mangos (about 2 mango)
2 tablespoons honey
1 teaspoon vanilla extract
1 cup water
¼ cup almonds (or walnuts)
1 ounce chia seeds

Topping:
2 mangoes seeded and cut into bite sized chunks
1 teaspoon honey
½ teaspoon lime zest
1 teaspoon lime juice

Directions:

• Blend Almonds with water until completely smooth (no almond chunks)
• In a large bowl combine mango puree, honey, and vanilla.
• Slowly whisk in almond water until mixture is smooth.
• Slowly whisk in chia seeds until completely combined
• Cover the bowl with plastic wrap and place in refrigerator for at least 4 hours (the longer the better, ideally overnight). Should be a porridge consistency. If not thick enough, add more Chia Seeds.
• Toppings: In a small bowl, combine mangoes, honey, lime zest and juice. Stir to combine. Store in airtight container.
• When ready to serve, put chia pudding into bowl, and add toppings. Enjoy!

1 serving is 1240 mg Omega-3’s
Lunch

Spicy Salmon Wraps

Ingredients

4 ounces cooked salmon (canned works too)
2 tablespoons chopped chipotles peppers in adobo sauce (look for the cans in the Hispanic foods section)
1 Flour tortilla
1/2 bell pepper, sliced (red, orange or yellow are my favorites)
1 cup spinach
2 sprigs cilantro.
Salt to taste

Directions:

• Start with some cooked salmon. I usually use dinner leftovers but you can also cook salmon up quickly on the stove top or in the oven. Simply cook salmon until it flakes apart easily and it is no longer bright pink in the middle. Or, use canned salmon.
• Flake the salmon with a fork. Add salt and chipotles to taste. Since I love my food spicy, I usually add more than 2 tablespoons. You may want to start with less, though.
• In a pan, give the bell peppers a quick sauté in some cooking spray. When the bell peppers are just tender, I throw in the spinach. Continue cooking until the spinach is just wilted.
• Heat the tortillas in a pan until they show light brown spots or in the microwave for 15 seconds each. Fill each tortilla with 4 ounces of the salmon mix and the veggies. Roll into a burrito

1 serving is 2060 mg Omega-3’s
Sardine Salad

Ingredients

1 can of sardines packed (preferably including bones)
1/2 tablespoon balsamic vinegar
1 large handful spinach
1 tomato, sliced into 8 wedges
1/4 small red onion, thinly sliced
1 oz feta cheese, crumbled
1/2 ripe avocado, cut into cubed and scooped out of its skin
Squeeze of lemon juice (optional)

Directions:

• Open the can of sardines and pour one tablespoon of the olive oil in the can into a bowl.
• Slowly add the balsamic vinegar as you whisk furiously with a fork until you have an
  emulsified vinaigrette.
• Add the spinach, tomato, and red onion to the bowl and toss until the vinaigrette is evenly
  distributed.
• Roughly cut the sardines into big chunks in the can.
• Top your salad with the half the sardines (or all of them if you’re hungry), feta, avocado
  cubes, and a squeeze of lemon juice.

1 serving is 1390 mg Omega-3’s
Salmon Nuggets

Ingredients

16 ounces salmon, skin removed
1 1/2 cup Panko bread crumbs
2 teaspoons minced garlic
2 teaspoons lime zest
pinch of salt and pepper
1 egg
1/2 cup flour
1/8 teaspoon kosher salt

Directions:

- Preheat oven to 400 degrees F. Line baking sheet with parchment paper and lightly coat with cooking spray.
- In small bowl, mix bread crumbs, garlic, lime zest, salt and pepper together.
- In separate bowl, whisk egg.
- In another bowl, stir together flour and salt.
- Cut salmon into 1 inch nuggets.
- Dredge salmon pieces through, flour; then egg; finally bread crumbs.
- Place salmon on baking sheet and mist pieces with cooking spray.
- Bake for 10 minutes. Serve with ketchup or tartar sauce.

1 serving is 2100 mg Omega-3’s
Dinner

Seafood Pasta

Ingredients

12 oz. thin spaghetti or linguini
2 cups broccoli florets
1 Tbsp. olive oil
1 Tbsp. chopped garlic
¼ tsp. red pepper flakes
2 tsp. anchovy paste
¼ cup dry white wine
Zest from one lemon
2 Tbsp. lemon juice
2 cans chopped clams with juice
8 oz. medium shrimp, peeled and tails off
2 Tbsp. fresh parsley
¼ cup fresh parmesan cheese

Directions:

• Cook pasta in large pot until al dente, drain and set aside.
• Meanwhile, microwave broccoli until just tender, 3-4 minutes. Drain well.
• Add olive oil to pot, sauté garlic and red pepper flakes for 1 minute. Add anchovy paste, wine, lemon zest, lemon juice, clams, and shrimp. Simmer for 3-4 minutes, just until shrimp is pink.
• Add pasta and broccoli to sauce, toss with parsley and fresh Parmesan cheese.

1 serving is 2100 mg Omega-3’s
Crusted Salmon

Ingredients

2 pounds salmon filets
3 tablespoons chopped pecans unsalted (can use almonds or walnuts as well)
1/4 cup parsley, chopped
1 cloves garlic, minced
Zest of 1 lemon
2 tablespoons olive oil
Salt & pepper

Directions:

• Preheat oven to 350°F (180°C).
• In a small bowl, combine pecans, parsley, garlic and lemon zest with olive oil.
• Season the salmon filets liberally with salt and pepper.
• Spread the topping evenly over the salmon filets.
• Bake salmon on a parchment lined baking sheet for 20 minutes or until fish is fully cooked.

1 serving is 2320 mg Omega-3’s
Cod with Thai Green Curry

Ingredients

2 teaspoons grapeseed or vegetable oil
2 tablespoons Thai green curry paste
1 ½ cups light coconut milk
1 tablespoon brown sugar
1 tablespoon lime juice
1 teaspoon fish sauce
4 (4 ounce) cod filets whole or cut into 1-inch pieces
1 red bell pepper, sliced
2 ounces snow peas
2 ounces canned bamboo shoots, drained
1 Thai chili pepper or ½ Serrano pepper, sliced (optional)
1/3 cup Thai basil or cilantro
Lime wedges for garnish (optional)

Directions:

• Heat the oil in a large sauté pan over medium heat and add the green curry paste.
• Sauté the curry paste 1-2 minutes until fragrant. Stir in the coconut milk and simmer a few minutes until it is thickened slightly. Stir in the brown sugar, lime juice and fish sauce.
• Place the cod filets in the pan and spoon the sauce over the top. Arrange the bell pepper, snow peas, bamboo shoots, chili pepper and half of the basil around the fish.
• Bring the sauce to a light simmer and then cover the pan. Cook until the cod is opaque and the vegetables are crisp tender, about 7-8 minutes. Sprinkle the remaining basil on top. Serve with steamed brown rice. Garnish with lime wedges.

1 serving is 690 mg Omega-3’s
LESSON 1
INTRODUCTION OF DIETARY FAT

DIFFERENT FATS

• Harmful Fats can increase:
  • Cholesterol
  • Risk of heart disease
  • Risk of Type 2 Diabetes
DIFFERENT FATS

• Healthy fats may help to improve:
  • Cholesterol levels
  • Insulin levels
  • Blood sugar control
  • May lower risk of
    • Type 2 diabetes
    • Heart disease

DIFFERENT FATS

Healthy
Monounsaturated Fats
Polyunsaturated Fats
Omega-3 Fatty Acids
Omega-6 Fatty Acids

Harmful
Saturated Fats
Trans Fats
SATURATED VS. UNSATURATED

Characteristics

• Saturated Fats:
  • Longer shelf life
  • Solid at room temp

• Unsaturated Fats:
  • Spoil quickly
  • Liquid at room temp

SATURATED VS. UNSATURATED

Food Source

• Saturated Fats:
  • Animal fats, butter, whole milk, meat, peanut butter, margarine, cheese, fried foods

• Unsaturated Fats:
  • Plant based, avocado, olive oil, fish, walnuts, flax seeds, cashews, beans, eggs, broccoli, oatmeal
TRANS FATS

- More harmful fat
- Raises bad cholesterol and lowers good cholesterol
- Naturally in animal products in small amounts
- Hydrogenated oil
TRANS FATS

- Why use it?
  - Long shelf life (does not spoil quickly)
  - Food label: < 0.5 grams trans fats – “0 g”

ESSENTIAL FATS

- Essential = Our bodies cannot make it on their own, has to come from the diet
- Example:
  - Omega-3 & Omega-6
POTENTIAL BENEFITS OF FAT

- May improve cholesterol
- May ↓ heart disease
- Can be beneficial for blood sugar control
- May help ↓ type 2 diabetes
- Part of a heart healthy diet
- May benefit insulin levels
- Can ↓ blood pressure

WHAT ARE OMEGA-3’S

- 3 fats considered omega-3’s
  - Alpha-linolenic acid (ALA)
    - in plant oils
  - Eicosapentaenoic acid (EPA)
    - in marine/fish oils
  - Docosahexaenoic acid (DHA)
    - in marine/fish oils
IMPORTANCE OF OMEGA-3 FOR EVERYONE

• May ↓ heart attacks, strokes, arthritis
  • Can ↓ triglycerides and LDL (bad cholesterol)
  • Possible ↑ of HDL (good cholesterol)
  • May contribute to eye function, visual sharpness, ↓ risk of eye diseases

IMPORTANCE OF OMEGA-3 FOR EVERYONE

• Local hormone production:
  • Regulates blood pressure
  • Immune/inflammatory response
  • Possibly ↓ cancer risk
  • Help prevent weight loss in chemotherapy patients
IMPORTANCE OF OMEGA-3 FOR EVERYONE

• May ↓ depression, anxiety, stress
  • (60% of the brain is fat)

• Possible memory improvement in healthy individuals

IMPORTANCE OF OMEGA-3 FOR EVERYONE

• Helps maintain hair and skin health

• Even good for pets!!!
  Helps keep coat and skin healthy
QUESTIONS?

WOULD YOU RATHER HAVE A RATIO OF:

ONE Omega-3 to every FOUR Omega-6’s

OR

ONE Omega 3 to every THIRTY Omega-6’s
OMEGA-3’S VERSUS OMEGA-6’S

• We should have a 1:4 ratio
• Americans average between 1:10 to 1:30 ratio
• So we need MORE omega-3’s and LESS omega-6’s

😊 QUESTIONNAIRE TIME 😊
REFERENCES


LESSON PLAN 2

IMPORTANCE OF OMEGA-3 FATTY ACIDS FOR PREGNANT AND BREASTFEEDING WOMEN

REVIEW

• Different types of fats
  • Saturated vs. Unsaturated
  • Trans Fat
  • Essential Fats
• Health benefits of dietary fat
• Omega-3 fatty acids
  • Ratio of omega-3 fatty acids to omega-6
IMPORTANCE OF OMEGA-3 FOR INFANTS

• May lead to ↑ IQ scores
• May play important role in normal function of:
  • Brain
  • Eyes
  • Liver
  • Kidneys
  • Other organs

IMPORTANCE OF OMEGA-3 FOR INFANTS

• May contribute to
  • Brain growth & development
  • May improve infant hand-eye coordination
IMPORTANCE OF OMEGA-3 FOR INFANTS

Omega-3’s during infancy and childhood may be linked to in development of food allergies, asthma and eczema (skin allergies).

IMPACT OF OMEGA-3 ON PREGNANCY AND BREASTFEEDING

• Mother’s dietary DHA intake during pregnancy and breastfeeding is very important.
IMPACT OF OMEGA-3 ON PREGNANCY AND BREASTFEEDING

• ↑ # of pregnancies may lead to ↑ risk of lower levels of omega-3 in newborns

IMPORTANCE OF OMEGA-3 AND LACTATION

• Supplementation linked to improved lactation
  • More research needed
WHY OMEGA-3 COULD INCREASE LACTATION

• May ↓ stress, depression, anxiety
• Could help calm mother & help with breastfeeding

WHY OMEGA-3 COULD INCREASE LACTATION

• May ↓ inflammation, blood pressure
• Potentially help mothers with letdown & ↓ engorgement
Importance of Omega-3 for Newborns

• Shown to:
  • ↓ low birth weight risks by 35%
  • ↓ risk of very early pre-term by 50%
  • ↑ infant getting to developmental goals by 64%
  • ↓ intensive care admissions

OMEGA-3’S AROUND THE WORLD

• In one study, intake of DHA in the United States was one of the lowest in the world
  • Only countries equal or lower were Pakistan, Canada, Rural South Africa
  • Highest: Japan, Canadian Arctic, Dominican Republic
PREMATURE INFANTS AND OMEGA-3

• Premature infants are at a higher risk of deficiency (especially <33 weeks)
• Omega-3 may decrease risk of having a premature infant

IMPORTANCE FOR DEVELOPMENT

• DHA may influence child’s language development
• Physical development
  • Sitting up
  • Grabbing objects
• The good news: it only takes 10 hours for omega-3 foods to make the breastmilk higher in omega-3's
OMEGA-3 RECOMMENDATIONS

Heart Foundation recommendation:
• Consume 500 mg of omega-3’s daily
• Include 2-3 servings of fish every week

WHO IS AT RISK?

• ↑ risk of Omega-3 deficiency:
  • Vegetarians
  • Lower income families
  • Not eating enough seafood
REFERENCES

LESSON PLAN 3
OMEGA-3 FOODS AND BARRIERS

REVIEW

- In one study, intake of DHA in the United States was one of the lowest in the world
  - Only countries equal or lower were Pakistan, Canada, Rural South Africa
  - Highest: Japan, Canadian Arctic, Dominican Republic
REVIEW

• DHA may influence child’s language development
• Physical development
  • Sitting up
  • Grabbing objects

Heart Foundation recommendation:
• Consume 500 mg of omega-3’s daily
• Include 2-3 servings of fish every week

OMEGA-3 RICH FOODS

Seafood
Plants
Nuts/Seeds
### Seafood Based Omega-3

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100 g = 3.5 ounces = 2 oysters

*Available through WIC checks*
PLANT BASED OMEGA-3’S

- Flaxseeds
- Hempseeds
- Cloves, Oregano, Marjoram, Tarragon, Mint, Basil, Sage & Rosemary
- Algal Oil (mostly DHA)
- Radish Seeds
- Chili Powder
- Sweet Red Peppers
- Yellow Onion

PLANT BASED OMEGA-3’S

- Chia Seeds
- Walnuts, Almonds & Pecans
- Soy Beans & Tofu
- Grape leaves
- Seaweed/Spirulina
- Leeks
- Fortified Eggs and Yogurt
- Beans (Pinto, Red & Navy)
OMEGA-3’S AND FOOD INTAKE

• Avoid fried and/or breaded foods
  • Due to omega-3:omega-6
• Cooking doesn’t decrease Omega-3’s by much
• Research suggests that selenium may inhibit mercury poisoning

OMEGA-3’S AND FOOD INTAKE

• Supplementation may not have the same impact as consuming foods high in Omega-3’s
  • 37% more absorption from natural oils
BARRIERS

• Vegetarians
• Low income families
• Not eating enough seafood

VEGETARIANS

Vegetarians do not eat enough seafood
• Alternative: Algal-oil may provide DHA similar to cooked salmon
• Can consume vegetable sources of omega-3s (ALA, not EPA/DHA)
INEXPENSIVE WAYS TO GET OMEGA-3S

Omega-3 Rich foods don’t always mean $$$
• Canned sardines, tuna, salmon, anchovies
• Weekly sales on fish
• Inexpensive supplements/vegetable oils high in omega-3

TRICKING YOUR TASTE BUDS

Find recipes that make it tastier for the picky eaters!
• Caesar dressing
• Fish sticks & fish cakes
• Smoothies with seeds and nuts
• Tons more!
REFERENCES


LESSON PLAN 4
MEAL PLANNING TO INCREASE OMEGA-3S

REVIEW

The Heart Foundation recommends that everyone should consume 500 mg of Omega-3's every day or eating two to three servings of fish every week.
REVIEW

Barriers:

• Vegetarians
• Low income families
• Not eating enough seafood

OMEGA-3 BREAKFAST IDEAS
OMEGA-3 BAR RECIPES

Ingredients:
• 1/2 cup dates
• 1/2 cup water
• 3/4 cup walnuts
• 1/2 cup hemp seeds
• 2 tablespoons chia seeds
• 2 tablespoons ground flaxseeds
• 1 cup ground oats

OMEGA-3 BAR RECIPES

Ingredients:
• 3.5 tablespoons unsweetened cocoa powder
• 1/4 cup semi-sweet chocolate chips
• 2 tablespoons coconut oil
• 1/2 cup shredded coconut
• 1/3 cup (83ml) of almond butter
OMEGA-3 BAR RECIPES

Directions:
• Preheat your oven to 375°
• In a small pot, make date puree with water and dates
• In a medium bowl combine all the ingredients: date puree, walnuts, hemp seeds, chia seeds, flaxseeds, cocoa powder, oats, chocolate chips, coconut oil, shredded coconut and almond butter

OMEGA-3 BAR RECIPES

• Mix until blended well and put in an oven dish. Spread mix and press gently to make it even
• Cook in the over for about 25 minutes or until golden
• When you remove it from the oven, let it cool completely before you take it out or you will end up with granola
OMEGA-3S PER SERVING

1 bar is
500 mg Omega-3’s

OMEGA-3 CHOCOLATE ‘MILK’ SMOOTHIE

Ingredients:
• 1-2 tablespoons Flaxseeds
• 1-2 tablespoons Chia seeds
• 1 teaspoon Hempseeds
• ¼ cup Walnuts
• 2-3 cups Water
OMEGA-3 CHOCOLATE ‘MILK’ SMOOTHIE

Ingredients:
• 1 tablespoon Cocoa Nibs
• 1 tablespoon Cocoa Powder
• 5 Dates
• 3 dashes of Cinnamon
• 1 Banana
• 1 cup Kale

Directions:
• Put all the ingredients in a good quality blender. Add only 1 cup of water at first, then add ½ cup until it’s the consistency you desire. You can also add a cup of ice instead of one cup of water (if preferred chilled).
• Make a large pitcher and save in the fridge. Enjoy!
OMEGA-3S PER SERVING

1 cup (8 ounces)
Is 760 mg Omega-3’s

OMEGA-3 LUNCH IDEAS
SPICY SALMON WRAPS

Ingredients

• 4 ounces cooked salmon (canned works too)
• 2 tablespoons chopped chipotles peppers in adobo sauce (look for the cans in the Hispanic foods section)

SPICY SALMON WRAPS

Ingredients

• 1 Flour tortilla
• 1/2 bell pepper, sliced
• 1 cup spinach
• 2 sprigs cilantro.
• Salt to taste
SPICY SALMON WRAPS

Directions

• Start with some cooked salmon. I usually use dinner leftovers but you can also cook salmon up quickly on the stove top or in the oven. Simply cook salmon until it flakes apart easily, no longer bright pink in the middle.

• Can use canned salmon.

SPICY SALMON WRAPS

Directions

• Flake the salmon with a fork. Add salt and chipotles to taste. Since I love my food spicy, I usually add more than 2 tablespoons. You may want to start with less, though.
SPICY SALMON WRAPS

Directions
• In a pan, give the bell peppers a quick sauté in some cooking spray. When the bell peppers are just tender, I throw in the spinach.
• Continue cooking until the spinach is just wilted.

Directions
• Heat the tortillas in a pan until they show light brown spots or in the microwave for 15 seconds each. Fill each tortilla with 4 ounces of the salmon mix and the veggies. Roll into a burrito.
OMEGA-3S PER SERVING

1 serving (6 ounces) is 2060 mg Omega-3’s

SALMON NUGGETS

Ingredients

- 16 ounces salmon, skin removed
- 1 1/2 cup Panko bread crumbs
- 2 teaspoons minced garlic
- 2 teaspoons lime zest
- pinch of salt and pepper
- 1 egg
- 1/2 cup flour
- 1/8 teaspoon kosher salt
SALMON NUGGETS

Directions

• Preheat oven to 400 degrees. Line baking sheet with parchment paper and lightly coat with cooking spray.
• In small bowl, mix bread crumbs, garlic, lime zest, salt and pepper together.
• In separate bowl, whisk egg.
• In another bowl, stir together flour & salt.

• Cut salmon into 1 inch nuggets.
• Dredge salmon pieces through, flour; then egg; finally bread crumbs.
• Place salmon on baking sheet and mist pieces with cooking spray.
• Bake for 10 minutes. Serve with ketchup or tartar sauce.
OMEGA-3S PER SERVING

1 serving
Is 2100 mg Omega-3’s

OMEGA-3 DINNER IDEAS
CRUSTED SALMON

Ingredients
• 2 pounds salmon filets
• 3 tablespoons chopped pecans unsalted (can use almonds or walnuts as well)
• 1/4 cup parsley, chopped
• 1 cloves garlic, minced
• Zest of 1 lemon
• 2 tablespoons olive oil
• Salt & pepper

CRUSTED SALMON

Directions
• Preheat oven to 350°F.
• In a small bowl, combine pecans, parsley, garlic and lemon zest with olive oil.
• Season the salmon filets with salt and pepper.
CRUSTED SALMON

Directions
• Spread the topping evenly over the salmon filets.
• Bake salmon on a parchment lined baking sheet for 20 minutes or until fish is fully cooked.

OMEGA-3S PER SERVING

1 serving
Is 2320 mg Omega-3’s
REFERENCES

• American Heart Association. (2014). Fish and omega-3 fatty acids. Retrieved from http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Fish-and-Omega-3-Fatty-Acids_UCM_303248_Article.jsp

• All Recipes are original recipes from Mor Levy, R.D.N.
**LESSON PLAN 5**

OVERALL REVIEW AND POTLUCK!

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**DIFFERENT FATS**

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OMEGA-3’S

• Important for a healthy heart
• May contribute to eye function, visual sharpness, ↓ risk of eye diseases
• May ↓ depression, anxiety, stress
  • (60% of the brain is fat)
• Possible memory improvement
IMPORTANCE OF OMEGA-3 FOR EVERYONE

• Local hormone production:
  • regulation of blood pressure
  • immune/inflammatory response
• Possibly ↓ cancer risk
• Help prevent weight loss in chemotherapy patients

IMPORTANCE FOR INFANTS

• May contribute to
  • Brain growth & development
• May improve infant hand-eye coordination
• Omega-3’s during infancy and childhood may be linked to ↓ in development of food allergies, asthma and eczema (skin allergies)
Importance of Omega-3 for Newborns

• Shown to:
  • ↓ low birth weight risks by 35%
  • ↓ risk of very early pre-term by 50%
  • ↑ infant getting to developmental goals by 64%
  • ↓ intensive care admissions

WHO IS AT RISK?

• ↑ risk of Omega-3 deficiency:
  • Vegetarians
  • Lower income families
  • Not eating enough seafood
## Seafood Based Omega-3

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PLANT BASED OMEGA-3’S

- Chia Seeds
- Walnuts, Almonds & Pecans
- Soy Beans & Tofu
- Grape leaves
- Seaweed/Spirulina

- Leeks
- Fortified Eggs and Yogurt
- Beans (Pinto, Red & Navy)

RECIPES

- Omega-3 Bar
- Chocolate “Milk” Smoothie
- Chia Seed Pudding
- Salmon Wraps
- Sardine Salad

- Salmon Nuggets
- Seafood Pasta
- Crusted Salmon
- Thai Green Curry Cod
REFERENCES