

# Fish as A Source of Micronutrients In Preventing The Risk of Pre-Eclampsia In Pregnant Women

Indonesian Nursing Journal of Education and Clinic (INJEC)

IN PRESS

Volume 6, Issue 2, December 2021

DOI: 10.24990/injecv6i2.429

[injec.aipni-ainec.org/index.php/INJEC/index](http://injec.aipni-ainec.org/index.php/INJEC/index)

Received : 2020-05-06

Accepted : 2021-07-11

The Association of Indonesian Nurse

Education Center (AINEC)



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## Abstract

**Introduction:** Pre-eclampsia is a pregnancy complication that is still a contributor to maternal and fetal deaths. Pre-eclampsia can be prevented by adopting a healthy lifestyle, which includes the fulfillment of nutritional needs during pregnancy. Fish can be a source of micronutrients for pregnant women to prevent pre-eclampsia.

**Methods:** The research design used was correlational with a cross-sectional approach. This study aims to analyze the consumption of fish-based nutrition as a source of adequate micronutrients in preventing pre-eclampsia in pregnant women. Data were obtained through questionnaires, structured interviews with a retrospective approach about fish consumption patterns during pregnancy. The sample used was 116 pregnant women in the third semester of the basic service in Jember Regency. Sampling was carried out with a questionnaire prepared by the researcher by modifying the FFQ (food frequency questioner) questionnaire in the last three months, in addition to observation/examination was also carried out to see the condition of the mother's pregnancy, structured interviews, and documentary studies for pre-eclampsia diagnosis. Data analysis was carried out by quantitative analysis using chi-square.

**Results:** The results showed that there was a relationship between fish-based nutrition consumption and the incidence of pre-eclampsia. P-value 0.014 with OR 2.69 and 95% CI 1.208-5.634. Micronutrient deficiency is the cause of the increasing cases of pre-eclampsia during pregnancy.

**Conclusion:** Support from all parties is needed so that pregnant women can consume fish that are safe and still hygienic and healthy in supporting their pregnancy.

## Keywords

fish-based nutrition; micronutrients; pre-eclampsia

## INTRODUCTION

The health of pregnant women is one of the important aspects to consider in a woman's life cycle because, during her pregnancy, the mother can experience unexpected complications and life-threatening risks

(Wagata et al., 2020). For a mother's pregnancy, childbirth, and postpartum period to run normally, mothers need good health services and also need adequate nutrition to be able to meet their nutritional needs during pregnancy. The nutrition of pregnant women is a major determinant of the health of the

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mother and the fetus (Forbes et al., 2018). Inadequate nutritional intake during pregnancy and a poor lifestyle can put the fetus at a higher risk of experiencing impaired wellbeing (Koenig, 2017). Balanced nutrition consists of various food intakes in appropriate amounts and proportions to meet a person's nutritional needs (Chen et al., 2016). The growth and development of the child are not only affected by conditions after birth but also in the womb (Symington et al., 2018). Fish is one of the important sources of nutrition for pregnant women in helping to meet the micronutrient needs of fetal development (Bakouei et al., 2020; Mousa et al., 2019). This study aims to analyze the consumption of fish-based nutrition as a source of micronutrient adequacy in preventing pre-eclampsia in pregnant women.

During pregnancy, the nutritional adequacy rate (RDA) needed by mothers is higher than women who are not pregnant (Oh et al., 2020). Nutrition during pregnancy is needed in large quantities for the fulfillment of maternal nutrition and fetal development in the womb (Brion et al., 2010; Zareei et al., 2019). Food requirements during pregnancy are not only in the portion eaten but must be determined by the quality of the nutrients contained in the food consumed (Caut et al., 2020). Adequacy of maternal nutrition can help prevent complications during pregnancy, including pre-eclampsia and anemia (Allen et al., 2014; Lee et al., 2013). Research on nutrition in global estimates shows that energy intake during pregnancy ranges from 7710 to 9260 kJ / day, with higher intakes reported in America and the Eastern Mediterranean compared to Africa, Southeast Asia and the West Pacific (Brion et al., 2010). Results of research on nutrition pregnant women in developed countries report that mothers consume 14.7% to 16.1% of the total energy from protein, which is adequate based on current recommendations (Aparicio et al., 2020). There are still many pregnant women who do not get enough micronutrient needs so that it harms pregnancy, namely 20-30% of pregnant women around the world experience vitamin deficiency, which causes miscarriage, not optimal fetal growth and development, premature birth, low birth weight and disability in infants and pre-eclampsia (Backes et al., 2011; Chen et al., 2016).

Pre-eclampsia is a pregnancy-specific syndrome, which is characterized by high blood pressure and proteinuria after 20 weeks of gestation (Backes et al., 2011; Shennan et al., 2018). It affects 2-8% of all pregnancies and causes 25% of all maternal mortality and perinatal morbidity. In 2018, the maternal mortality rate (MMR) of East Java Province reached 91.45 per 100,000 live births, while data from Jember district were 114.31 / 100,000 live births (East Java Provincial Health Office, 2019).

Pre-eclampsia can be prevented by adopting a healthy lifestyle, which includes the fulfillment of nutritional needs during pregnancy, including micronutrients (Chen et al., 2016; Qureshi et al., 2020). Micronutrient deficiency is the cause of the increasing cases of pre-eclampsia during pregnancy. Mothers need adequate intake, especially at the beginning of the formation of the placenta during pregnancy (Aparicio et al., 2020). Micronutrients are nutrients in the form of vitamins and minerals and, although the quantity needed can be said to be small, they have a very important role in metabolic processes and several other roles in the body's organs (Health Service Executive, 2016). Lack of intake and absorption of micronutrients can result in disturbances in health, growth, mental, and other functions (cognitive, immune system, reproduction, etc.) (Mousa et al., 2019).

There are many changes in the mother, both physical and hormonal, and the body needs an important nutritional composition for pregnant women consisting of macronutrients and micronutrients (Bezerra Maia e Holanda Moura et al., 2012). Macronutrients are important substances that must be contained in any healthy diet, namely carbohydrates, proteins, fats, or minerals (Zareei et al., 2019). Meanwhile, micronutrients are additives that the body usually cannot produce on its own. The need for each type of nutrition during pregnancy is very different from the nutritional needs when not pregnant (Mousa et al., 2019). During pregnancy, mothers need an additional 300 calories from food, especially in the second and third trimesters. Pregnant women also need certain nutritional nutrients in small amounts, but they are important for the growth and development of the fetus in the womb (De Carvalho et al., 2017). Micronutrients are very important nutrients

and must be available as a complement to pregnant women's diet. Some of the micronutrient needs that increase during pregnancy are essential vitamins and minerals, such as folic acid, vitamins A and B complex, iron, calcium, and others (Oh et al., 2020). Fish is a source of micronutrients that are very much needed for both pregnant women and society in general. By consuming fish, it is hoped that the mother will get the nutrition needed for the growth and development of her fetus (Forbes et al., 2018). Some of the nutritional content in fish varies greatly, so an analysis of fish nutrition is needed, both in fresh and processed conditions (Koletzko et al., 2019). These nutrients are protein, fat, folic acid, calories, cholesterol, vitamins, and iron (Oh et al., 2020). Supplementation of n-3 fatty acids from fish is an effective strategy to prevent the incidence of pre-eclampsia in

women with low-risk pregnancies. The results of an observational study show that pre-eclamptic women have lower levels of long-chain omega-3 polyunsaturated fatty acids (LCPUFAs) (Bakouei et al., 2020). Therefore, an analytical study is needed on the consumption of fish-based nutrition as a source of micronutrient adequacy in preventing pre-eclampsia in pregnant women.

**MATERIALS AND METHODS**

This study used a correlational design with a cross-sectional approach. Data were obtained through questionnaires, structured interviews, documentary studies, with a retrospective approach to fish consumption patterns during pregnancy. The questionnaire is arranged based on development of the FFQ (food frequency questionnaire).

Table 1. Demographic data of respondents (age, education, number of children, occupation, income)

	<b>n</b>	<b>%</b>
<b>Age</b>		
< 20 years old	15	12.9
21-30 years old	32	27.6
>30 years old	69	58
<b>Total</b>	<b>116</b>	<b>100</b>
<b>Education</b>		
Elementary School	25	21
Junior High School,	53	44.5
Senior High School,	38	31.9
<b>Total</b>	<b>116</b>	<b>100</b>
<b>Number of children</b>		
1	22	18.96
2	48	41.3
3 or more	46	39.6
<b>Total</b>	<b>116</b>	<b>100</b>
<b>Occupation</b>		
Housewife	55	46.2
Laborer,	38	31.9
Self-employed	16	13.4
Government employees	7	5.9
<b>Total</b>	<b>116</b>	<b>100</b>
<b>Income</b>		
less than standard (regional minimum wage) Rp 2.500.000	46	38.7
the same as the standard regional wages	60	50.4
more than standard	10	8.4
<b>Total</b>	<b>116</b>	<b>100</b>

Table 2. Analysis of fish consumption habits with the incidence of pre-eclampsia

<b>Pre-eclampsia</b>	<b>Pre-eclampsia</b>		<b>P-value:</b>	<b>CI 95 %</b>
<b>fish consumption habits</b>	yes	no		
yes	25	23	0.014	1.208 -5.634
no	20	48	OR: 2.69	
<b>Total</b>	<b>45</b>	<b>71</b>		

The research sample was 116 pregnant women in the 3rd semester, with quota sampling technique for mothers who visited basic services to check their pregnancy in the period April-September 2021. Sampling used a questionnaire compiled by the researcher based on development of the FFQ (food frequency questionnaire) with a focus on the mother's daily nutritional consumption in the last three months, as well as observations/examinations were also carried out to see the condition of the mother's pregnancy and documentation studies to diagnose pre-eclampsia. Univariate data analysis is by frequency tabulation and bivariate techniques using the chi-square test.

Ethical approval was obtained from the Research Ethics Committee at the Faculty of Health Sciences University of Muhammadiyah Jember.

## RESULTS

Respondents in this study were 3rd-trimester pregnant women with the largest number, aged more than 30 years, the average education of respondents was junior high school as much as 53%, at the current pregnancy status the average pregnant woman was the second child. In the analysis between daily consumption of fish-based nutrition and the incidence of pre-eclampsia using chi square, a value of 0.014 was obtained, meaning that there is a relationship between the two, while the OR 2.69 women who do not consume fish on the daily menu will be at risk of experiencing pre-eclampsia as much as 2.69 times.

## DISCUSSIONS

Pregnancy causes an increase in energy metabolism and nutrients needed for fetal growth and development (Roberts et al., 2012). Lack of certain nutrients needed during pregnancy can cause the fetus to grow imperfectly. The World Health Organization (WHO) recommends an additional amount of 150 Kcal a day in the first trimester, and 350 Kcal a day in the II and III trimesters (Caut et al., 2020). Nutritional needs are not only the nutrients contained in the food consumed. Nutrition of pregnant women before and during pregnancy has an important role in reproductive health and optimizing pregnancy

outcomes (Content & Process, 2013; Schoenaker et al., 2015). Unbalanced maternal nutrition and poor metabolism can lead to poor pregnancy outcomes. Optimal maternal nutritional supply plays an important role in the growth and development of the fetal placenta. Micronutrients such as folic acid, vitamin D, iron, calcium, and omega-3 fatty acids regulate placental development and functional performance (Fogacci et al., 2020). The results of this study prove that there is a relationship between mothers who consume fish in their daily diet with the incidence of pre-eclampsia. Consuming fish as food which contains high antioxidants and folic acid can help reduce the risk of pre-eclampsia in pregnant women.

Fish is a type of healthy food with low saturated fat content, but lots of protein content. In addition, fish also has one important nutrient for mothers during pregnancy, namely omega-3 fatty acids. This type of unsaturated fatty acid plays an important role in the development of brain cells, nerves, and eyes of the baby in the womb. Some fish also contain quite complete vitamins and minerals which are useful for keeping the mother's body healthy (Endeshaw et al., 2014b; Nafsiyah et al., 2018). Salmon contains 534 mg of potassium per 3-ounce serving. Potassium in fish can help lower blood pressure in pregnant women with pre-eclampsia (Bakouei et al., 2020).

Pre-eclampsia in pregnancy may be caused by abnormal placentation and maternal reactions, (Burton et al., 2019). During normal development, cytotrophoblast placentation will invade the maternal spiral arteries (Rugolo et al., 2011). As a result, blood vessels with small flow capacities will transform into large capillary capacities. Furthermore, it will lose the endothelial layer and viscoelastic tissue (Ministry of Health, 2018). These changes in architecture allow for an increase in blood flow. Pre-eclampsia can manifest as early as mid-pregnancy. In pregnant women with pre-eclampsia, cytotrophoblast invasion occurs more superficially so that the invasion does not reach the arteries and even invades some arteries but does not produce sufficient transformation (Abedi et al., 2014; Content & Process, 2013; Roberts et al., 2012)

Thus, placental blood flow will increase in response to increased fetal demands, but the result of abnormal placentation will result in ischemia. In general, fatty acids and LCPUFA

play many roles at this stage of pregnancy. During implantation, fatty acids and LCPUFA are required as structural components and functional regulators for normal growth processes (Abedi et al., 2014). Fish is a source of omega-3 micronutrients which are important in helping the development of maternal pregnancy (Abedi et al., 2014; Ghosh & Ghosh, 2004). Amino acids and prostaglandin derivatives are important mediators of vascular permeability and cytotrophoblast invasion. However, excessive prostaglandins can lead to implantation failure (Caut et al., 2020). Therefore, abnormal omega-3 or omega-6 ratios may favor excessive inflammatory and oxidative events that inhibit or impair embryonic development and placentation

Fish and seafood are sources of omega-3 fatty acids. These fatty acids are included in the group of essential fatty acids because the body cannot produce them itself and can only be obtained from food consumed daily (Schoenaker et al., 2015). Long-chain omega-3 LCPUFAs, including EPA and DHA, are dietary fats that have a variety of benefits. Omega-3s have a very important role in the body, especially in cell membranes, anti-inflammatory processes, and cell membrane viscosity. The main dietary sources of omega-3 LCPUFA are fish and seafood (Brion et al., 2010; Ghosh & Ghosh, 2004). Antioxidant supplementation with polyunsaturated fatty acids, especially omega-3 fatty acids, is useful in the management of pre-eclampsia. Folate plays a role in DNA and RNA biosynthesis and homocysteine metabolism. Folic acid reduces the risk of pre-eclampsia by lowering homocysteine levels, improving endothelial cell function and being associated with placental development and implantation (Bakouei et al., 2020; Endeshaw et al., 2014a). However, further research is needed to evaluate other potential benefits of gestational fatty acid supplementation for mothers and infants.

## CONCLUSION

The results of this study were able to prove that there was a relationship between the fulfillment of fish-based maternal nutrition and the incidence of pre-eclampsia. However, there are still many cultures that consider it taboo to consume fish during pregnancy, so it needs the cooperation of all parties to increase

public understanding of the positive culture of consuming fish.

## Acknowledgement

This research was carried out with financial support from the University of Muhammadiyah Jember in the main research program.

## Conflict of Interest

The Authors declare that there is no conflict of interest.

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