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The Effect of Docosahexaenoic Acid (DHA) Administration on Tumor Necrosis Factor Alpha (TNFα) Levels in Underweight Pregnant Women

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A B S T R A C T

***Background*:** Fulfillment of nutritional needs in pregnant women greatly affects the nutritional status of the fetus in the womb and will determine the growth and development of the baby, especially during the growth period (golden age). In the mother's womb, brain cells undergo various stages of development, namely from proliferation, migration, synaptogenesis to apoptosis. Adequate nutrition is the main and most important factor that plays a role in determining the success of body and brain growth in the fetus. The purpose of this study was to determine the effect of DHA intake on TNFa levels in underweight pregnant women. ***Methods*:** The research approach used was cross-sectional and interviews were conducted directly with 21 pregnant women patients in Made Suarabaya District. ***Results*:** The average levels of TNFa in underweight pregnant women before and after DHA administration were as follows: 163,746±66,591 and 133,339±39,159 respectively. ***Conclusions*:** There is a significant positive effect of providing DHA intake to underweight pregnant women.
Keywords: Underweight pregnant women, DHA, TNFα.

INTRODUCTION

Pregnancy requires special attention because it is an important period in the 1000 days of life. Pregnant women are one of the groups vulnerable to nutrition. The nutritional intake of pregnant women greatly affects fetal growth (Ministry of Health of the Republic of Indonesia, 2018).

Chronic Energy Deficiency (CED) is a nutritional problem that can occur in pregnant women due to an imbalance between energy and protein intake and needs. CED is characterized by the size of the Upper Arm Circumference (LiLA) in pregnant women of less than 23.5 cm. Nutritional problems and weight loss in pregnant women can cause decreased immunity and pregnant women become increasingly susceptible to oxidative stress. According to data from the 2018 Basic Health Research (RISKESDAS), the prevalence of CED risk in pregnant women aged 15-49 years in Indonesia was 17.3%. However, there was a decrease to 9.7% in 2020. In 2018, Riskesdas reported that East Java was one of the provinces in Indonesia with a prevalence of CED in women of childbearing age above the national average (19.6%). Riskesdas also stated that the prevalence of women of childbearing age (15-49 years) who are pregnant and at risk of KEK in Indonesia is 27.6%, while national data shows that the prevalence of women of childbearing age who are pregnant and at risk of KEK is 26.8%.

Recent studies have shown that TNFα imbalance at the fetal-maternal interface is associated with adverse pregnancy outcomes, including preeclampsia (PE), intrauterine growth restriction (IUGR), spontaneous abortion (SA), preterm birth, and others (Ghazanfari T *et al*., 2020).

Advances in neurobiology and cognitive neuroscience have begun to uncover some of the mechanisms that allow these effects to occur. The brain is an organ rich in fat, accounting for 60%. Nerve cells receive nutrients, especially fat, most of which are Long Chain Poly Unsaturated Fatty Acid (LC-PUFA), especially Docosahexaenoic Acid (DHA). DHA is the largest component of LC-PUFA, found in abundance in brain cells and the retina (Phang M *et al*., 2009). During the period of brain growth and development, AA and DHA content increases in the nerve cell membrane. With this fact, it is suspected that AA and DHA play an important role in the process of brain growth and development, especially when the brain grows rapidly, namely in the third trimester of pregnancy until the age of 2-3 years (Soetjiningsih, 2000).

MATERIAL AND METHOD

This study according to data collection, is an experimental study, data for each variable is collected by observation and using treatment. This study according to its design is an analytical epidemiological study with a cross-sectional approach. This study according to its data analysis is an analytical study using a comparative study hypothesis test between two variables before and after treatment. This study aims to study the correlation of giving behavior in the form of DHA supplementation to underweight mothers on TNFα levels as a supplement within a specified period of time in Made sub-district, Surabaya. In this study, the data that has been obtained will later be analyzed using univariate and bivariate analysis. Univariate analysis is used to describe the characteristics of each variable studied without connecting it to other variables. Bivariate analysis is used to analyze the relationship between two variables, namely the dependent variable and the independent variable and to see the influence that is in accordance with the hypothesis that has been formulated. The variable that will be tested using bivariate analysis is the relationship between DHA administration and TNFα levels.

RESULTS AND DISCUSSION

Based on the results of the normality test using the Shapiro Wilk test (because N < 50), it was obtained for TNFa Pre p 0.043 where < 0.05 is stated as abnormal, while for TNFa Post p 0.271 where > 0.05 is stated as normal.

Based on the results of the normality test, it was found that the TNFa Pre data was declared abnormal, so the pre vs post comparison test on TNFa used the Wilcoxon test, based on the results of the Wilcoxon test, a p value of 0.005 was obtained where <0.05, which means there is a significant difference in TNFa at pre and TNFa at post where based on the mean or median value, it was found that TNFa post was smaller than TNFa pre, this means that the treatment given was able to reduce TNFa and the decrease was stated as statistically significant / meaningful.

In this study, data collection was carried out using only 1 group consisting of 19 samples of underweight pregnant women at the Made Health Center with 2 behaviors being implemented, where the first sample was blood drawn before being given DHA supplements while the second sample was given DHA supplementation for 30 days. Underweight is a condition of low body weight according to age and underweight during pregnancy. Often people who are underweight also have a high risk of nutritional deficiencies (WHO, 2019).

The results of the study showed that there was an effect of DHA administration on TNF-a levels in pregnant women with underweight which can be seen in table 5.12. Another study concluded that his study had a significant relationship between the Effect of acute omega 3 supplementation reducing serum tumor necrosis factor-alpha (TNF-a) levels, pain intensity, and maintaining muscle strength after high-intensity weight training reducing serum TNF-a levels (p-0.035), significantly reducing pain levels (p-0.007), and not reducing strength while eating (p-0.100) (Novandri, *et al*., 2022).

Then another study stated that there was a relationship between omega 3 supplementation and decreasing Tumor Necrosis Alpha (TNF-a) levels Bonferroni post hoc, p <0.001 (Gutierrez-Pliego *et al*., 2018).

Then in Yogi's study there was a relationship Omega-3 fatty acid supplementation can reduce tumor necrosis alpha (TNF-α) levels and pain intensity in osteoarthritis patients. The results obtained on TNF-α with a P value = 0.007 and pain intensity with a P value = 0.001 which showed significant results (Yogi *et al*., 2024).

CONCLUSION

Based on research and discussions regarding the effect of Docosahexaenoic Acid (DHA) supplementation on TNFa levels in underweight pregnant women, several conclusions were drawn. The study conducted at the Made District Health Center in Surabaya included pregnant women aged 16 to 36 years, with gestational ages ranging from 7 to 38 weeks. Before DHA supplementation, the TNFa levels in underweight pregnant women were abnormal, ranging from 73 to 323 ng/ml, with an average of 163.746 ng/ml. After 30 days of DHA supplementation, TNFa levels normalized, with a range of 66 to 200 ng/ml and an average of 133.339 ng/ml. The results indicate a significant effect of DHA

supplementation on TNFa levels, with a notable increase in TNFa levels and a significance value of <0.001 between pre- and post-supplementation measurements.

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