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The Effect of Olive Oil Intake on Oleic Acid Levels in the Breast Milk of Lactating Mothers (6-24 months) in Indonesia

*Sry Novi Yanti Sofya¹, Citrakesumasari², Healthy Hidayanthy², Razak Thaha², Balqis³, Zainal ⁴

¹Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

²Department of Nutrition Science, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia ³Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia ⁴Department of Food Technology, Faculty of Agriculture, Hasanuddin University, Makassar, Indonesia

(Received: 2	27 October 2023	Revised: 22 November	Accepted: 26 December)			
KEYWORDS	ABSTRACT: Introduction: Oleic acid serves as a precursor for producing AA and DHA, which contribute to the visual, immune, cognitive, and motor development of new-borns.					
Olive Oil, Fat Intake, Breast Milk	Objectives : This study aimed to determine the effect of olive oil intake on increasing the level of oleic acid in the breast milk of nursing mothers aged 6-24 months.					
Dicust Mink,	Methods: This read breastfeeding mot consisting of 16 read	search is a Randomized Controlled Tri hers aged 6-24 months who were rando espondents in the intervention group a	al (RCT). The sample in this study was 30 omly selected and divided into two groups, and 14 respondents in the control group.			
	Results : The aver intake and oleic ac the control group after treatment. In	age age of respondents was 29 ± 5.2 years in the intervention group, the control group, there was an increase of the control group, there was an increase of the control group, there was an increase of the control group, t	ears. There was a significant change in fat nation group (P< 0.05), but not significant in a level of oleic acid increased by 0.14 g/L se of 0.02 g/L.			
	Conclusions : The acid in breast milk and oleic acid level	ere was a significant difference in the after treatment between the interventi els were significantly changed after tre	change in fat intake and the level of oleic on and control groups (P<0.05). Fat intake eatment.			

1. Introduction

Fat is the second largest macronutrient in breast milk and plays the most important role in nutrient intake and development of the central nervous system. The content of oleic acid in breast milk in several periods of lactation tends to be stable (1). The fat content in breast milk is characterized by the high content of palmitic acid and oleic acid (2)(3). The composition of nutrient content in breast milk is alpha-lactalbumin and fatty acids (4). Oleic acid plays an important role in lowering the melting point of triglycerides needed for the formation, transportation, and metabolism of milk fat and as a precursor for producing AA and DHA, which function in the visual development, immunity, cognitive, and motor skills of newborns (5). The results of research conducted by Asmi AD and Citrakesumasari 2021 suggest that the average level of oleic acid in breastfeeding mothers aged 6-12 months is 1.00 g/L and aged 12-24 months is 0.99 g/L (6). This is still low when compared to the oleic acid levels of other countries. Research by Butts et al in 2018 states that the level of oleic acid in the New Zealand community is 1.5gr/L (7). Lack of oleic acid can cause vision problems, decreased brain function, brain power, and the presence of brain cell growth disorders in infants (8).

Oleic acid contributes more than 90% of total MUFA in breast milk, this is influenced by the Mediterranean diet intake which consumes foods high in oleic acid, especially in olive oil (9). Salam AA in 2015 stated that the consumption of olive oil can improve health status, especially during pregnancy and breastfeeding (10). This

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is in line with research conducted by Karacor K & Meryem Cam in 2015 that oleic acid is abundant in olive oil (11).

Intervention for 14 days showed changes in total cholesterol, LDL, HDL, and triglyceride levels in rats significantly (12). Based on the above explanation, the researcher is interested in identifying the effect of giving olive oil on the increase in oleic acid levels in the breast milk of breastfeeding mothers aged 6-24 months.

2. Objectives

This study is expected to provide information related to the benefits of other nutrient components of breast milk, namely Oleic Acid, which is still little known, thus prompting researchers to look at fat intake with Oleic Acid levels in breast milk in breastfeeding mothers.

3. Methods

The type of research is a Randomized Controlled Trial (RCT). This study was conducted during the period of March-June 2023 at the Tamalanrea Community Health Center located in the Tamalanrea Subdistrict and Sudiang Raya in the Biringkanaya Subdistrict, Makassar City, and analyzed at the Hasanuddin University Hospital Laboratory, Makassar. The sample in this study was 30 breastfeeding mothers with toddlers aged 6-24 months, divided randomly into 2 study groups where one group received treatment in the form of olive oil (virgin oil) which is a source of oleic acid, and education about the sufficiency of breastfeeding mother's diet, while the control group received only education about diet sufficiency. The inclusion criteria in this study were: Breastfeeding mothers aged 18-40 years, mothers who have toddlers aged 6-24 months, willing to provide breast milk samples, willing to fill out a research questionnaire, being in the working area of the Tamalanrea and Sudiang Raya Community Health Centers and not currently taking other medications.

Data Collections

Primary data was collected from questionnaires, 24-hour food recall sheets, and FFQ data. In addition, the researcher directly measured the weight and height of the respondents. Oleic acid data was taken from breast milk samples of mothers with infants aged 6-24 months who met the criteria, which were then analyzed in the Hasanuddin University Hospital laboratory. Secondary data in the form of a general description of the research location was obtained from the records of the Tamalanrea and Sudiang Raya health centers in 2022.

Breast milk collection is conducted between 09.00-11.00 WITA and lasts for 10 minutes. The breast pump used is consistent throughout the study and is an electric pump from the brand Real Bubee with serial number RBX-8023S-2. The expressed breast milk is placed in a storage container, specifically a Gea Baby plastic breast milk bag, and filled with the volume produced from the breast pump. The bag is then placed in a Green Lay cool box, adhering to standard practice, using an ice cooler inside. However, the temperature is not measured. It is then brought to the Research Laboratory at Unhas Public University Hospital for storage in a specialized refrigerator at a temperature of -20°C.

To examine the level of oleic acid in the breast milk, only 5-10 ml samples are taken, and the Enzyme-Linked Immunosorbent Assay (ELISA) method is used. All primary data from the research results, including baseline data and examination results of the oleic acid concentration in breast milk of both the intervention and control groups, are calculated, and analyzed. Statistical tests including Mann Whitney, T-Test, and Wilcoxon are then carried out using the SPSS 24 program.

4. Results

The baseline data in this study show that the average respondent of breastfeeding mothers is between 20-35 years old, and there is no significant difference between the intervention and control groups based on the mother's age (P-value = 0.234). Around 43% of the respondents' education is in high school, with most breastfeeding mothers being homemakers. There is no significant difference either in the education or job of mothers between the intervention and control groups (P-value 0.234 and 0.708). Most of the respondents have a normal nutritional status and there is a significant difference between the intervention and control groups based on the mother's nutritional status (P-value = 0.003).

Table 1. Baseline Data of Breastfeeding Mothers in theWorking Areas of Sudiang Raya and Tamalanrea PublicHealth Centers

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Characteristics	Intervention	Group		0/	P-
Respondent	Group	Control	n	%	Value
Mother's Age					
<19 Years	0	0	0	0%	0.224
20 - 35 Years	14	13	27	90%	0.234
>35 Years	2	1	3	10%	
Mother's Education					
Elementary School	0	0	0	0%	
Middle School	3	0	3	10%	0.709
High School	4	9	13	43%	0.708
DIPLOMA	4	2	6	20%	
Bachelor's Degree	5	3	8	27%	
Mother's Occupation					
Housewife	13	14	27	91%	
Entrepreneur	1	0	1	3%	0.955
Private Employee	1	0	1	3%	
Civil Servant	1	0	1	3%	
Mother's Nutritional					
Status					
Underweight	3	0	3	10%	0.002
Normal	10	12	22	73%	0.005
Overweight	2	1	3	10%	
Obesity	1	1	2	7%	

The effect of olive oil administration on the oleic acid content in the breast milk of breastfeeding mothers in the intervention and control groups

This study's results indicate a significant difference in the oleic acid levels of breastfeeding mothers' breast milk before and after the administration of olive oil intervention as much as 20 ml/day for 2 weeks, with a P-value of 0.006 < 0.05.

Table 2. Changes in Oleic Acid Levels in theIntervention Group and Control Group

Group	Pre-Test			Post Test				Р
	(Mean±SD)	Min	Max	(Mean±SD)	Min	Max		Value
Intervention	0.57±0.34	0.34	1.41	0.71±0.77	0.36	3.21	0.14	0.006
Control	0.69±0.18	0.35	2.71	0.67±0.21	0.34	2.67	0.02	0.730
P Value	0.967			0.124				

Based on data from the control group (p-value 0.157>0.05), no significant variation was found in oleic acid levels before and after the intervention. This aligns with observations of fat intake in the control group, which did not show a significant change and even tended to decrease after a two-week period. The average fat intake showed a decrease of 4.15 grams in the control group. Meanwhile, carbohydrate intake in the control group also showed a decreasing trend, with a reduction of 8.78 kcal.

Table 3. Analysis of Average Nutrient Intake Before andAfter Olive Oil Administration in the Intervention andControl Groups

Variable	Pre-test	Post-test		Р	
variable	(Mean±SD)				
Fat Intake					
Intervention	43±26	63.01±21.52	20.01	0.021	
Control	56.01±40.05	46.45±30.31	9.55	0.683	
P Value	0.228	0.01			
MUFA					
Intervention	9.13±6.31	25.30±6.88	16.17	0.000	
Control	10.94 ± 8.21	12.41±8.41	1.47	0.73	
P Value	0.118	0.000			
Oleic Acid					
Intervention	0.46±0.94	14.44 ± 0.58	13.98	0.000	
Control	0.86±1.38	0.45 ± 0.78	0.41	0.327	
P Value	0.98	0.000			

Another determinant factor in this study is that the fat intake of the intervention group increased by 20.01 grams between the before and after treatment periods. This increase can be directly linked to the additional consumption of olive oil included in their diet during the intervention period. The Wilcoxon test results show a significant difference in the average fat intake before and after the treatment in the intervention group (P<0.05). On the other hand, the control group, which did not receive olive oil intervention, showed a different pattern. In this case, the average fat intake decreased by 9.55 grams. However, the Wilcoxon test indicates that this change is not significant (P>0.05). This means that, unlike the intervention group, changes in fat intake in the control group may be more due to natural variability in dietary patterns, not because of the intervention. These results suggest that adding olive oil to the diet of breastfeeding mothers can significantly contribute to the increase in their total fat intake. This has potential implications for nutrition strategies, especially if it is found that increasing certain fat intake can positively impact the quality and composition of breast milk.

5. Discussion

Virgin olive oil, also known as extra virgin olive oil, is obtained from the oil of olive fruits through a process of washing, decantation, centrifugation, and physical filtration under specific conditions and temperatures that do not cause changes to the oil. The majority of the lipid content in extra virgin olive oil consists of oleic acid (55-83%), followed by approximately 4-20% linoleic and linolenic acid, and small amounts of stearic and palmitic acid (saturated fats)(26)(27)(28).

Oleic acid accounts for more than 90% of the total monounsaturated fatty acids (MUFA) in breast milk, influenced by the high Mediterranean diet that includes foods rich in oleic acid (15). A study by A. Salem also

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states that the consumption of olive oil can improve health status, especially during pregnancy and lactation (10). Phenolic compounds such as hydroxytyrosol, tyrosol, oleuropein, and ligustrazine found in olive oil are responsible for its health benefits, including antioxidant activity, protection against lipid oxidation, antiinflammatory properties, potential anti-carcinogenic effects, resistance to oxidative stress, and more (16)(17).

This study's results indicate a significant difference in the oleic acid levels of breastfeeding mothers' breast milk before and after the administration of olive oil intervention as much as 20 ml/day for 2 weeks, with a P-value of 0.006 < 0.05. This aligns with the research conducted by Greta which states that there is a relationship between food intake containing fatty acids and the concentration of fatty acids in breast milk (18)(7)(19).

The difference in oleic acid levels can be attributed to the difference in fat intake among the participants in this study compared to the study conducted by Asmi et al (6). The average fat intake in the intervention group was 41.35 grams with an oleic acid level of 0.66 g/L, while the average fat intake in the previous study was 57.95 grams with an oleic acid level of 0.99 g/L. This is consistent with the study conducted by Keikha which states that the fatty acid composition of breast milk is influenced by maternal food intake (20). Intervention studies have shown that supplementation with high-fat dairy products affects the composition of breast milk. Other studies have also explained the relationship between maternal fat intake and overall fat content in breast milk ((21). Fatty acids in breast milk can be synthesized in the mammary glands, mobilized from maternal stores such as adipose tissue, and directly supplied from the mother's intake (food and supplements) (22)(23)(24).

However, when compared with previous studies, the levels of oleic acid in breastfeeding mothers' breast milk are still considered low. One of the factors causing differences in this study is the individual fat intake of Mediterranean populations that are high in monounsaturated fatty acids (especially oleic acid), showing high concentrations of oleic acid in breast milk (P=0.024), influenced by the habit of consuming olive oil, containing 40% MUFA. The characteristics of Mediterranean intake are high consumption of legumes

and high intake of olive oil (extra virgin olive oil) used as the main fat source, as a result total fat intake can be high (around 40% of total energy) in Greece, or medium (around 30% of total energy intake) in Italy (29)(30). The Mediterranean diet is known for its high intake of plantbased foods (fruits, vegetables, grains, potatoes, legumes, and nuts) and high consumption of olive oil (especially extra virgin olive oil) as a fat source. It also includes a moderate intake of dairy products (such as yogurt and cheese), 0-4 eggs per week, moderate consumption of poultry and fish, and limited consumption of red meat (25).

6. Conclusion

The administration of olive oil does impact the levels of oleic acid in the breast milk of mothers in the intervention group.

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