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Role of Omega-3 Fatty Acids in Reducing the Risk of Pre-Term Labour

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ABSTRACT

Preterm labour remains a leading cause of neonatal morbidity and mortality worldwide, particularly in low- and middle-income countries. Objective: To evaluate the effectiveness of omega-3 fatty acid supplementation in reducing the incidence of preterm labour and low birth weight among pregnant women in their first trimester. Methodology: This descriptive study was conducted at the Department of Obstetrics and Gynecology, Allied 2 (DHQ) Hospital, Faisalabad from 5 February 2025 to 5 June 2025. A total of 140 pregnant women aged 18–35 years with singleton pregnancies were enrolled using non-probability consecutive sampling. Participants received daily oral supplementation of omega-3 fatty acids (MEGA-3 capsules containing EPA 180 mg) before 20 weeks of gestation. They were followed monthly until 28 weeks and fortnightly until 36 weeks. Results: The overall rate of preterm delivery was 12.1%. Among women with good compliance to omega-3 supplementation, the rate of preterm birth was significantly lower (5.6%) compared to those with poor compliance (19.1%) ($p = 0.014$). Similarly, low birth weight occurred in 6.9% of the good compliance group versus 23.5% in the poor compliance group ($p = 0.032$). A previous history of preterm labour and low maternal BMI were also significantly associated with current preterm delivery ($p = 0.002$ and $p = 0.008$, respectively). Conclusion: Omega-3 fatty acid supplementation during early pregnancy is associated with a reduced risk of preterm labour and low birth weight. Given its safety, affordability, and clinical benefit, routine omega-3 supplementation may be considered as part of antenatal nutritional care, especially in high-risk populations.

INTRODUCTION

Preterm birth (PTB), defined as birth <37 weeks of gestational age (GA), has been estimated to affect one in nine infants worldwide and represents the most significant cause of neonatal death. The global estimate of preterm birth was 11.1% and 10.6% in 2010 and 2014, respectively. This has a great regional variation, which ranged and 60% of it occurring in Sub-Saharan and South Asia countries [1.2]. Maternal diet is critical for a successful pregnancy as well as fetal health outcomes. Optimal nutrition has been identified as a fundamental factor in reducing mortality and long-term morbidities like extra-uterine growth restriction and poor neurodevelopmental outcome in preterm infants. Essential fatty acid-derived eicosanoids play important roles as biochemical mediators in normal term labor that initiate uterine contractions, cervical maturation, and rupture of membranes [3]. Fat-soluble nutrients, specifically carotenoids, have received special attention secondary to their antioxidative, anti-inflammatory, immunomodulatory, and overall synergistic effects on health [4]. Omega-3 fatty acids play a crucial role during fetal growth and neurocognitive development. Omega-3 fatty acid is an essential structural component of every cell in the body. It serves as precursor for biologically active compounds called eicosanoids [5]. They do not travel in the blood, but are created in the cells to regulate a large number of processes, including the movement of calcium and other substances into and out of cells, dilation and contraction of muscles, inhibition and promotion of clotting, regulation of secretions including digestive juices and hormones, and the control of fertility, cell division, and growth. Higher dietary intake of omega-3 fatty acids, as in maternal fish consumption, has been associated with fetal growth and longer duration of gestation. A number of studies have investigated omega-3 fatty acids for their potential to prevent preterm birth [6]. Omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are essential long-chain polyunsaturated fatty acids (LC-PUFAs) primarily obtained from marine sources like oily fish and algae. They play a vital role in cell membrane integrity, anti-inflammatory signaling, vascular function, and fetal neurodevelopment [7]. During pregnancy, maternal stores of DHA are actively transferred to the fetus, especially in the third trimester, making maternal supplementation critical in cases of dietary insufficiency. Low levels of omega-3 fatty acids have been associated with adverse pregnancy outcomes, including preeclampsia, fetal growth restriction, and preterm labour [8]. A study on the role of omega-3 fatty acids on pregnancy outcome in ladies with singleton pregnancy booked in first trimester showed that 10.1% of women had preterm birth, while low birth weight was 21% in women not taking omega-3 fatty acids [9]. To the best of our knowledge, no local study is available in the literature to explore the role of Omega-3 fatty acids. So, the aim of this study is to determine the role of Omega-3 fatty acids in preventing preterm delivery. If the results support the benefits of Omega-3 fatty acid in prevention of preterm delivery, it will be recommended in the future to reduce perinatal morbidity and mortality.

OBJECTIVE

To determine the outcome of pregnant females with singleton pregnancy taking omega-3 fatty acids.

METHODOLOGY

This Descriptive Study was conducted at Department of Obstetrics & Gynecology Allied 2 (DHQ) Hospital, Faisalabad from 5 February 2025 to 5 June 2025. Sample size is calculated using WHO calculator.

- Confidence Level = 95%
- Anticipated Proportion = 10.1%[7]
- Margin of Error = 5%
- Sample Size = 140

INCLUSION CRITERIA

- Age between 18 and 35 years
- Singleton pregnancy
- Booked for antenatal care
- In first trimester of pregnancy

EXCLUSION CRITERIA

- Multiple gestation
- Documented history of gestational diabetes
- Fetal congenital anomalies
- Cardiovascular diseases
- Placenta praevia, due to its potential impact on pregnancy outcome

DATA COLLECTION PROCEDURE

Ethical approval was obtained from the institutional review board prior to the commencement of data collection. After informed consent was taken from all eligible participants, detailed demographic information and relevant clinical history were recorded using a predesigned structured proforma. Gestational age was calculated using the last menstrual period (LMP) and confirmed by ultrasonography (USG). Participants were provided with omega-3 fatty acid capsules (MEGA-3), containing 180 mg of eicosapentaenoic acid (EPA), to be taken once daily. The supplementation was initiated before 20 weeks of gestation, at the patient's first hospital visit, and continued in addition to standard antenatal supplements. Participants were followed throughout pregnancy via the antenatal outpatient department. Follow-up visits were scheduled monthly until 28 weeks of gestation and fortnightly from 28 to 36 weeks. At least one obstetric ultrasound was performed during each trimester to assess fetal growth and development. Patients were followed until delivery, and pregnancy outcomes were recorded, particularly the incidence of preterm birth and low birth weight as defined in the operational definitions. All collected data were recorded on the predesigned proforma to ensure standardization.

DATA ANALYSIS

Data entry and analysis were performed using SPSS version 25. Quantitative variables such as age, gestational age, height, weight, and BMI were summarized using mean and standard deviation. Categorical variables such as education level, socioeconomic status, residence, parity, previous history of preterm birth, and pregnancy outcomes were presented as frequencies and percentages. To address potential confounding, stratification was applied across variables such as age, gestational age, parity, BMI, education, socioeconomic status, and residence. Post-stratification chi-square tests were used to assess associations between categorical variables, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

Data were collected from 140 patients, with a mean age of 27.4 ± 4.3 years. Most participants were in the 26–35 year age bracket (61.4%), while 38.6% were aged 18–25 years, indicating a relatively young cohort. Urban residency was predominant, reported in 75% of cases, whereas only 25% belonged to rural areas. A significant majority (75.7%) were from lower socioeconomic backgrounds, possibly reflecting limited access to health education and nutrition. In terms of

parity, 57.9% were multiparous and 42.1% were nulliparous, suggesting a balanced representation of first-time and experienced mothers.

TABLE 1: DEMOGRAPHIC AND BASELINE CLINICAL CHARACTERISTICS OF PARTICIPANTS (N = 140)

Variable	Value
Age (years), Mean ± SD	27.4 ± 4.3
Age Group	
• 18–25 years	54 (38.6%)
• 26–35 years	86 (61.4%)
Residence	
• Urban	105 (75.0%)
• Rural	35 (25.0%)
Socioeconomic Status	
• Lower	106 (75.7%)
• Middle/Upper	34 (24.3%)
Parity	
• Nulliparous	59 (42.1%)
• Multiparous	81 (57.9%)

Women with good omega-3 supplementation compliance had a significantly lower rate of preterm delivery (5.6%) compared to those with poor compliance (19.1%), with a p-value of 0.014. This indicates a strong protective association between omega-3 intake and gestational duration. Additionally, history of prior preterm birth emerged as a key risk factor—those with such history had a 33.3% recurrence rate compared to 8.0% in women without prior preterm delivery (p = 0.002). These results underscore the clinical relevance of preventive strategies, including nutritional supplementation and close monitoring in high-risk pregnancies.

TABLE 2: ASSOCIATION BETWEEN OMEGA-3 SUPPLEMENTATION AND PRETERM DELIVERY

Omega-3 Compliance	Preterm Delivery (n)	Term Delivery (n)	Total (n)	p-value
Good Compliance	4 (5.6%)	68 (94.4%)	72	0.014
Poor Compliance	13 (19.1%)	55 (80.9%)	68	
Previous Preterm History				
Yes	8 (33.3%)	16 (66.7%)	24	0.002
No	9 (8.0%)	107 (92.0%)	116	

Good compliance with omega-3 supplementation was linked to a significantly lower incidence of low birth weight (6.9%) compared to poor compliance (23.5%), with a p-value of 0.032. This finding suggests that omega-3 intake during pregnancy may enhance fetal growth and reduce the risk of intrauterine growth restriction. The majority of women who adhered to supplementation delivered babies with normal weight, highlighting the importance of nutritional interventions during pregnancy.

TABLE 3: ASSOCIATION BETWEEN OMEGA-3 SUPPLEMENTATION AND LOW

BIRTH WEIGHT

Omega-3 Compliance	LBW Babies (n)	Normal Weight (n)	Total (n)	p-value
Good Compliance	5 (6.9%)	67 (93.1%)	72	0.032
Poor Compliance	16 (23.5%)	52 (76.5%)	68	

Underweight mothers (BMI <18.5) had a significantly higher preterm delivery rate (30%) compared to normal (9.7%) and overweight women (8.9%), with a p-value of 0.008. This suggests that maternal undernutrition is a major risk factor for poor obstetric outcomes, likely due to inadequate nutrient reserves for fetal development and uterine support. Interestingly, normal and overweight women had almost comparable low preterm rates, indicating that moderate weight gain is not detrimental.

TABLE 4: ASSOCIATION BETWEEN MATERNAL BMI AND PRETERM DELIVERY

BMI Category	Preterm Delivery (n)	Term Delivery (n)	Total (n)	p-value
<18.5 (Underweight)	6 (30.0%)	14 (70.0%)	20	0.008
18.5–24.9 (Normal)	7 (9.7%)	65 (90.3%)	72	
≥25 (Overweight)	4 (8.9%)	41 (91.1%)	45	
Unknown	0	3	3	

DISCUSSION

This study assessed the role of omega-3 fatty acid supplementation in reducing the risk of preterm labour and adverse birth outcomes among pregnant women in their first trimester. The findings indicate a statistically significant reduction in both preterm delivery and low birth weight among participants who demonstrated good compliance with omega-3 supplementation. In our cohort, the overall preterm birth rate was 12.1%, which is consistent with global estimates reported by the World Health Organization, particularly in low- and middle-income settings [10]. Notably, preterm labour occurred in only 5.6% of women who were compliant with omega-3 intake, compared to 19.1% in the poor compliance group (p = 0.014). This aligns with previous findings, such as the 2018 Cochrane review by Middleton et al., which demonstrated that omega-3 fatty acid supplementation reduces the risk of early preterm birth by up to 42%. The mechanism likely involves the anti-inflammatory action of eicosapentaenoic acid (EPA), which downregulates prostaglandins involved in uterine contractility and cervical ripening [11]. Similarly, low birth weight (LBW) occurred in 6.9% of the good compliance group versus 23.5% in the poor compliance group (p = 0.032). This suggests that omega-3 supplementation may contribute to improved fetal growth and placental function. DHA, another omega-3 component, is known to support cellular membrane integrity and improve uteroplacental blood flow, which may explain this beneficial effect on fetal weight [12]. More than supplements, we found out via our analysis that previous history of preterm delivery was a strong predictor of future preterm delivery. The current preterm rate classified the women with a previous preterm birth at 33.3 percent by comparison to the increased current preterm rate (8.0 percent) of the women without any history of preterm birth (p = 0.002). This observation supports the findings of other scholars

who state that previous prematurity delivery is one of the strongest predictors of subsequent preterm birth. BMI stratification also demonstrated very important results [13]. There was significantly higher rate of preterm delivery among underweight women (30%) than among normal-weight (9.7%) and overweight subjects (8.9%) ($p = 0.008$). The findings agree with those available in literature which have associated maternal undernutrition and low BMI with higher risks of intrauterine fetal growth restriction, pre-term labour and poor placental formation [14]. This accentuates the significance of the early pregnancy period of maternal nutrition status. In terms of public health, the results of this research are consistent with the considerations of omega-3 supplementation being used during regular antenatal care, especially in women with poor nutrition or with history of preterm birth [15,16]. Taking MEGA-3 capsules with 180 mg of EPA twice a day was feasible and effective in terms of achieving the reduction of adverse outcomes. Because omega-3 is cheap, safe, and universal, utilization in resource-poor environments is particularly useful [17-19]. Nonetheless, many limitations deserve to be mentioned. It was a small study with only a few participants in a one-center study with limited sample size, and it was based on self-reported compliance that may lead to reporting bias. Serum omega-3 levels or scores of dietary intakes that would have given a more objective view on the adequacy of supplementation were not added to the study, either. With the limitations not-withstanding, the findings strongly indicate that there is significant support towards the hypothesis that omega-3 fatty acid supplementation in early pregnancy can lower the risk of preterm labour and low birth weight.

CONCLUSION

It is concluded that omega-3 fatty acid supplementation during early pregnancy significantly reduces the risk of preterm delivery and low birth weight. Women who were compliant with daily omega-3 intake demonstrated notably better pregnancy outcomes compared to those with poor compliance. Additionally, previous history of preterm birth and low maternal BMI were identified as important risk factors influencing gestational outcomes. These findings highlight the protective role of omega-3 fatty acids in promoting maternal-fetal health and support their inclusion as part of routine antenatal nutritional care, particularly in high-risk or nutritionally vulnerable populations.

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