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**RESEARCH PAPER**

# Improving Maternal Health: Assessing the Impact of Nutritional Supplements to Combat Malnutrition

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**ABSTRACT**

This research aimed to determine the micronutrient deficiency in pregnant and lactating women in pregnant and lactating women at District Toba Tek Singh, Faisalabad, Punjab, Pakistan by utilizing anthropomorphic measurements and biomedical tests. . A convenient sampling technique was used with 160 patients. Two groupd were made with ≤ 6 months post-pregnant lactating women and pregnant women in the 2nd or 3rd Trimester. Group A received lipid-based supplements, while Group B didn't received supplements. A structured nutritional assessment performa was developed for data collected. This study revealed that the pregnant and lactating women from low socioeconomic backgrounds found micro nutritional deficiencies. However, upon comparing the control group to the interventional group, it was observed a significant improvement in the Hemoglobin (HGB) parameter among the women in latter stages. This study recommended that the health agencies and government ensure accessibility of supplements and promote awareness for pregnant and lactating women.

**KEYWORDS** Maternal, Health, Lipid-Based Micro Nutrients Supplement, Malnutrition, Pakistan

## Introduction

The average duration of pregnancy is 40.0 weeks or 280 days (Liao et al., 2005) During pregnancy, there are three trimesters. Micronutrient insufficiency increases several hazards, including anemia, pregnancy-induced hypertension, restricted fetal development, pre-eclampsia, more complicated delivery, and mother and fetal death, both during conception and during pregnancy ( Khayat, 2017). Malnutrition and anemia during pregnancy were common causes of maternal morbidity and mortality in developing nations like Pakistan with preeclampsia-related problems occurring often (19 percent). The nation had maternal death rates of 319 per 100,000 live births, placing it third in the world in terms of fetal, maternal, and child mortality (Sher et al., 2022). It is difficult to accomplish the UN Sustainable Development Goal (UNSDG) to "address the nutritional requirements of adolescent girls and pregnant and lactating women by 2030" because of nutritional inadequacies in reproductive women. The World Health Organization (WHO) suggests using a combination of vitamin supplementation, health education, and food fortification to address nutritional deficits among women throughout the reproductive period. Similar initiatives have been launched in several areas and nations to address the nutritional issues for women during the reproductive period and to battle malnutrition (Jiang et al., 2022).

The Recommended Dietary Allowance (RDA) statistics are used to establish a pregnant woman's suggested daily micronutrient consumption. Pregnant women should consume 60 g of protein daily, and carbohydrates should account for 45 to 64 percent of daily calories, including 6 to 9 servings of whole grains daily. A healthy diet should contain 20 to 35 percent of its calories from fat (Kominiarek et al., 2016).

The recommended daily allowances (RDAs) for the majority of vitamins during pregnancy and breastfeeding are shown in below table (Medicine, 2006).

**Table 1**
**Recommended Daily Dietary Allowances for Pregnant and Lactating Women**

| Nutrient | Non-pregnant | Pregnant | Lactation |
|---|---|---|---|
| Vitamin A (mg/d) | 700 | 770 | 1300 |
| Vitamin D (mg/d) | 5 | 15 | 15 |
| Vitamin E (mg/d) | 15 | 15 | 19 |
| Vitamin K (mg/d) | 9011 | 90 | 90 |
| Folate (mg/d) | 400 | 600 | 500 |
| Niacin (mg/d) | 14 | 18 | 17 |
| Riboflavin (mg/d) | 1.1 | 1.4 | 1.6 |
| Thiamine (mg/d) | 1.1 | 1.4 | 1.4 |
| Vitamin B6 (mg/d) | 1.3 | 1.9 | 2 |
| Vitamin B12 (mg/d) | 2.4 | 2.6 | 2.8 |
| Vitamin C (mg/d) | 75 | 85 | 120 |
| Calcium (mg/d) | 1000 | 1000 | 1000 |
| Iron (mg/d) | 18 | 27 | 9 |
| Phosphorus (mg/d) | 700 | 700 | 700 |
| Selenium (mg/d) | 55 | 60 | 70 |
| Zinc (mg/d) | 8 | 11 | 12 |

Lipid-based nutritional supplements (LNS) refer to a class of dietary supplements that are formulated with a high concentration of lipids (fats). These supplements were commonly used to address malnutrition, particularly in vulnerable populations like infants, children, and pregnant or lactating women. LNS products were designed to provide essential nutrients, including fats, to promote healthy growth and development. A widely recognized and researched application of lipid-based nutritional supplements was, in the treatment of childhood malnutrition, specifically severe acute malnutrition (SAM). LNS has been proven effective in promoting weight gain and improving nutritional status in children with SAM (Gera et al., 2017).

According to the United Nations International Children's Emergency Fund (UNICEF) provided the product specification for lipid-based nutrient supplements (LNS) intended for pregnant and lactating women (PLW). LNS was a nutritional intervention specifically designed to address maternal undernutrition and to enhance mother and child health outcomes. The product specification comprised LNS formulation's composition, nutritional value, packaging, and quality requirements, which were developed for Pregnant and Lactating Women (PLW). The formulation offered a concentrated number of important vitamins, minerals, and macronutrients and was specifically created to suit the nutritional needs of pregnant and breastfeeding women. The safety and effectiveness of the supplement were guaranteed by adherence to the defined quality criteria, making it an important tool for reducing maternal malnutrition and enhancing mother and child health outcomes. It is important to remember that the LNS should be used in conjunction with a balanced diet and that competent medical advice is always required to ensure its optimal use and efficiency[8]. (UNICEF, 2022). Sher et al. (2022) conducted a study to understand the Effects of lipid-based Multiple micronutrient supplements on the birth outcome of underweight pre-eclamptic women. Pre-eclampsia is a dangerous pregnancy condition characterized by elevated blood pressure and organ damage, including the liver and kidneys. The mother's and the child's long-term health could suffer if key micronutrients like iron, calcium, zinc, and vitamins were not consumed in sufficient amounts. Essential micronutrients were combined with lipids (fats) as dietary supplements known as lipid-based nutritional supplements (LNS). This strategy increased vitamin bioavailability and absorption, which could be especially helpful for pre-eclamptic women who were underweight because they found it difficult to achieve their nutritional needs through a regular diet alone (Khayat, 2017).

The United Nations International Children's Emergency Fund, has released a product standard for lipid-based nutrient supplements (LNS) that are meant for pregnant and breastfeeding women. LNS is a nutritional intervention created to address maternal undernutrition and improve health outcomes for both mothers and children. The product specification outlines the composition, nutritional content, packaging, and quality standards of the LNS formulation designed specifically for pregnant and lactating women. This particular supplement has been designed to meet the nutritional requirements of pregnant and breastfeeding women, with high levels of essential vitamins, minerals, and macronutrients. Our team has adhered to strict quality standards to ensure the safety and efficacy of the supplement, making it an indispensable resource in the fight against maternal malnutrition and the enhancement of maternal and child health outcomes. It is vital to bear in mind that the supplement should be taken in conjunction with a balanced diet and under the guidance of a medical professional to achieve optimal efficacy ( Gera et al., 2017)..

According to the "National Nutrition Survey" (NNS), 2018 in Pakistan, the malnutrition rate among women between the ages of 15 and 49 who are fertile is double. 14.4 percent of people are undernourished, down from 18–14 percent in 2011, but the number of obese and overweight people is rising. This was 28 percent in the report from 2011; however, it increased to 37.8 percent in the report from 2018. According to recent studies, zinc deficiency is more prevalent in rural areas (24.3 percent) compared to urban areas (18.7 percent). In particular, Punjab has the highest percentage of women of reproductive age (WRA) with zinc deficiency, with 24.1 percent suffering from this condition. Balochistan and Sindh follow closely behind with 23.4 percent each (UNICEF, 2022).

Since 2001, Nutrition International has been working in Pakistan to enhance the health of those in need, particularly women and children, by providing them with better nutrition. In collaboration with national and provincial governments, the organization aims to increase and maintain the coverage of vitamin A supplementation for children under five throughout Pakistan, improve the coverage and utilization of zinc supplements and oral rehydration salts to manage childhood diarrhea, ensure that young girls, pregnant women, mothers, and children aged six to 24 months living in remote rural areas of Pakistan receive better nutrition and healthcare, improve the effectiveness of the national and provincial universal salt iodization program, support the Scaling Up Nutrition (SUN) movement by hosting the SUN Civil Society Alliance and SUN Academia and Research Network, reach 50 million people with fortified wheat flour and 148 million people with fortified edible oil or ghee, and improve the levels of iron, vitamin B12, and folic acid among children and women (“Pakistan,” n.d.). In June of 2022, the World Food Programme assisted a significant number of expectant mothers and children under the age of five. Specifically, 76,635 expectant mothers and 100,318 children were provided with individualized, nutritious meals and medical care through the WFP's countrywide initiative known as 'Benazir Nashonuma'. This particular program aims to prevent stunted growth and is designed to assist those individuals registered with the government (National Nutrition Survey, 2018).

The program consisted of the provision of preventative lipid-based nutrition-based supplements (wheat soya blend plus (WSB+) to pregnant and lactating women (PLW). A program was implemented in Pakistan to provide nutrient supplements, referred to as LNS-MQ, to children between 6 and 23 months old. Additionally, behavior change communication messages were aimed at mothers. The program was incorporated into the primary healthcare system via the Government of Pakistan's Lady Health Worker (LHW). The LHWs, who are essential to maternal and child healthcare services in Pakistan, were responsible for administering the intervention. By providing specialized nutrition supplementation, it was hoped that maternal and neonatal health outcomes will improve (World Food Programme Pakistan, 2022).

Therefore, this research aimed to determine the extent of micronutrient deficiency in pregnant and lactating women, utilizing anthropometric measurents and biomedical tests. Additionally, it sought to evaluate the effectiveness of Lipid-Based Nutrient Supplements (LNS-PLW) in pregnant and lactating women, using the same methods. Furthermore, the study intended to provide recommendations for nutritional supplements during pregnancy and lactation. This research has a profound impact on medical practice, patient care, and public health. It addresses various aspects of the condition, leading to improved overall well-being of women with nutritional deficiency. As research continues, it will undoubtedly bring further insights and advancements, leading to better healthcare practices and improved quality of life for pregnant and lactating women.

## Methodology

### Study Area

For study, in Pakistan, Punjab province, District Toba Tek Singh was selected after getting Ethical Approval from the Ethics Review Committee of Government College University, Faisalabad. Toba Tek Singh is a District in Punjab, Pakistan with 30.9709° North, 72.4826° East, and has a population of 1.6 million. Also, our study covers the residential areas with a population of low socioeconomic status, where pregnant and lactating women met different challenges regarding health and nutritional status.


Figure 1: Map of Toba Tek Singh

### Study Design

This was a randomized controlled trial. Randomization in a study decreases the probability of bias. In this study, the interventional group (≤ 6 months post-pregnant lactating women and pregnant women in the 2nd or 3rd Trimester) was provided with Lipid-Based Nutrient Supplements by the World Food Program through Community Health Workers, and data was analyzed by collecting specific variables in a given period and follow-up period from both pregnant and lactating women.As the study was a randomized controlled trial, a prospective study, that measures the effectiveness of an intervention that includes Lipid-Based Nutrition Supplements in pregnant and lactating women. Thus, it was a bit time-consuming due to the follow-up period in data collection

### Study Setting

The study was conducted by the Government College University, Faisalabad, and at District Toba Tek Singh after getting Ethical Approval from the Ethics Review Committee of Government College University, Faisalabad. This is especially crucial when using personal information or culturally significant study areas, or when using human or animal subjects.

### Sample and Sampling Technique

The Sample size consisted of 160 female individuals. Those female individuals who were either ≤ 6 months post-pregnant lactating women and pregnant women in the 2nd or 3rd Trimester included. The consent form was provided to these female participants and

informed consent was obtained from these enrolled pregnant and lactating women. A convenient Sampling Technique was used in this study. In this type of sampling, we selected only those samples that were easily available, easy to approach, and agreed to participate in the research.

**Study Population**

A total of 160 patients were divided into two groups: Group A and Group B. Both groups comprised all the ≤ 6 months post-pregnant lactating women and pregnant women in the 2nd or 3rd Trimester. The women of Low socioeconomic status, who were getting benefits from the Benazir Income Support (BIS Nashonuma program) were included in the study. These women visited the Facilitation Centers of the BIS program at community health centers of DHQ/ THQ to get Lipid-based Nutrient supplements.

Group A is regarded as an interventional group because they received lipid-based nutrient supplements from the World Food Program through Community Health Workers, while Group B is regarded as a control group because they didn't receive the lipid-based nutrient supplements. These pregnant and lactating women were identified through community health workers and meetings with mothers in the study area.

**Inclusion/ Exclusion Criteria**

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Women aged 20 – 35 years | Women aged > 35 and < 20 years |
| ≤ 6 months post-pregnant lactating women and Pregnant Women in 2nd or 3rd Trimester | ≤ 6 months lactating women and Pregnant women in 1st Trimester |
| Healthy post-pregnant lactating women and Pregnant Women in 2nd or 3rd Trimester. | Women who were severely ill during pregnancy |
| The women from Low socioeconomic status who were eligible for the Benazir Income Support (BIS) Nashonuma program | Women who are hypertensive, diabetic, or have any metastatic disease or other chronic disease. |
| Women from District Toba Tek Singh | Women above Low socioeconomic status who were not eligible for the Benazir Income Support program |

**Data Collation Tool**

A structured research Proforma was used which was named a nutritional assessment form. It contained the demographic variables (name, age, pregnancy or lactating), data about physical examination (Skin, Nails, Eyes, Hairs), anthropometric data (BMI, Height, Weight, and MUAC), and CBC parameters including WBC, RBC, HGB, PLT, and HCT.

**Ethical Approval**

This is especially important when employing sensitive subjects like people or animals, sensitive cultural study locations, or personal information. Data was collected from ≤ 6 months post-pregnant lactating women and Pregnant Women in the 2nd or 3rd Trimester. Women from District Toba Tek Singh were included. For data collection healthy females from 20 – 35 years of age were selected. The women of Low socioeconomic status who were eligible for the Benazir Income Support (BIS) Nashonuma program were included in this

study. This study only included respondents who provided their consent. The detail was recorded on the data collection proforma/nutritional assessment form that included anthropometric measurements and biochemical methods

**Steps for Measuring Nutritional Status**

The four components of **ABCD** are primarily involved in determining the nutritional state of each individual and are crucial in determining that person's nutritional status. These are solid bases on which to gauge nutritional health. All nutritional forms must contain them. These are covered in further depth below.

Anthropometric Assessment

Biochemical Methods

Clinical Assessment

Dietary Evaluation

**Development of Nutritional Assessment Questionnaire/ Proforma**

A structured research Proforma named a nutritional assessment form recorded all the demographic variables, data about the physical examination, psychological complications, dietary history, anthropometric data, and CBC parameters including WBC, RBC, HGB, PLT, and HCT before intervention.

**Statistical Analysis**

Upon collection of the data, the subsequent step entailed meticulous entry and analysis. While various software options such as Excel, Minitab, and SPSS are available for analysis, we opted to use IBM SPSS Statistics Software. Our analysis encompassed both qualitative and quantitative variables.

**Results and Discussions**

The nutritional evaluation Performa includes demographic profile such as name, age, income level, education level, pregnancy trimester, total pregnancies, lactating, receiving lipid-based nutritional supplements and any allergic reactions after LHS consumption. In this study, statistically analyze the pre-assessment and post-intervention data in the intervention group, we utilized parametric and non-parametric tests. The results of parametric tests were presented as mean ± standard deviation, with a p-value of ≤ 0.05 being considered significant.

**Table 2**
**Baseline characteristics of the respondent**

| Age of respondent | Frequency | Percent |
|---|---|---|
| 21-25 | 12 | 7.5 |
| 26-30 | 92 | 57.5 |
| 31-35 | 56 | 35.0 |
| Total | 160 | 100.0 |
| **Respondent Income** | | |
| 6000-10000 | 19 | 11.9 |
| 11000-15000 | 39 | 24.4 |
| 16000-20000 | 54 | 33.8 |
| 21000-25000 | 37 | 23.1 |
| 26000-30000 | 10 | 6.3 |
| 31000-35000 | 1 | .6 |
| Total | 160 | 100.0 |

| | | |
|---|---|---|
| **Respondent Education** | | |
| Illiterate | 137 | 85.6 |
| Literate | 23 | 14.4 |
| Total | 160 | 100.0 |
| **Respondents** | **Lactating** | **Pregnant** |
| Control | 20 | 60 |
| Interventional | 20 | 60 |
| Total | 40 | 120 |
| **Allergic reactions after LNS consumption** | **No** | **Yes** |
| Lactating | 19 | 1 |
| Pregnant | 57 | 3 |
| Total | 76 | 4 |

As per Table 1, the majority of the women, 92 women, in my study lie in the age group 26 – 30 years, while 12 women lie in the age group 21 – 25 years, whereas 56 women lie in the age group 31 – 35 years.The income level of most participants lies between 16000 – 20000, while 37 participants have an income level between 21000 – 25000, while only 1 person has an income level between 31000 – 35000. Most of my participants, about 85.6%, were illiterate and only 14.4% were Literate. This study has 20 lactating and 60 pregnant female participants in both control and interventional groups. The total participants make up to 160 participants.

## Pre-Consumption and Post-Consumption LNS Psychological Complications

We use the Pearson chi-square test to assess the psychological complications in the control group of both lactating and pregnant women of the 2nd and 3rd trimesters. The level of significance was taken as ≤ 0.05. My results showed significance ≤ 0.05, which stated that there was a significant difference between the collected data on psychological complications in both lactating and pregnant women over three months.

**Table 3**
**Pre & Post-LNS-Consumption Psychological Complications of control and Interventional Group**

| Pregnant or Lactating | | Value | df | Significance (2-sided) |
|---|---|---|---|---|
| Control | Pregnant | **41.707** | 4 | **.000[a]** |
| | Lactating | **9.474** | 1 | **.002[a]** |
| Interventional | Pregnant | **17.500** | 4 | **.002[a]** |
| | Lactating | **19.304** | 3 | **.000[a]** |

**Table 4**
**Physical Examination (Skin, Nails, Eyes, Hair) in control and interventional group**

| Control Group<br>Pregnant or Lactating (Skin) | | Value | df | Significance (2-sided) |
|---|---|---|---|---|
| Pregnant | Pearson Chi-Square | 97.180 | 4 | .000[a] |
| Lactating | Pearson Chi-Square | 40.000 | 4 | .000[a] |
| **Pregnant or Lactating (Nails)** | | | | |
| Pregnant | Pearson Chi-Square | 99.259 | 4 | .000[a] |
| Lactating | Pearson Chi-Square | 20.000 | 1 | .000[a] |
| **Pregnant or Lactating (Eyes)** | | | | |
| Pregnant | Pearson Chi-Square | 19.133 | 1 | .000[a] |
| Lactating | Pearson Chi-Square | 7.389 | 1 | .007[a] |
| **Pregnant or Lactating (Hair)** | | | | |
| Pregnant | Pearson Chi-Square | 161.818 | 9 | .000[a] |
| Lactating | Pearson Chi-Square | 32.381 | 6 | .000[a] |
| **Interventional**<br>**Pregnant or Lactating (Skin)** | | | | |
| Lactating | Pearson Chi-Square | 9.286 | 2 | .010[a] |
| Pregnant | Pearson Chi-Square | 43.403 | 4 | .000[a] |
| **Pregnant or Lactating (Nails)** | | | | |
| Lactating | Pearson Chi-Square | 9.474 | 2 | .009[a] |
| Pregnant | Pearson Chi-Square | 76.167 | 4 | .000[a] |

| | | | | |
|---|---|---|---|---|
| **Pregnant or Lactating (Eyes)** | | | | |
| Lactating | Pearson Chi-Square | 3.158 | 1 | .076[a] |
| Pregnant | Pearson Chi-Square | 1.499 | 1 | .221[a] |
| **Pregnant or Lactating (Hair)** | | | | |
| Lactating | Pearson Chi-Square | 29.375 | 4 | .000[a] |
| Pregnant | Pearson Chi-Square | 119.408 | 9 | .000[a] |

We use the Pearson chi-square test to assess the physical examination (Skin, nails, eyes, and hair) in the control group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. The level of significance was taken as ≤ 0.05. As per Table 4.31, my results showed significance ≤ 0.05, which stated that there was a significant difference, however for eyes level of significance was ≥ 0.05, which stated that there was no significant difference between the collected data on physical examination (Skin, nails, and hair) before and after three months.

## Pre-Consumption and Post-Consumption Lns Dietary Evaluation in Control and Intervwntional Group

To assess the dietary evaluation (calories and water intake) in the control and interventional group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. The level of significance was taken as ≤ 0.05. As per Table 3, my results showed a significance of ≤ 0.05 for calorie intake and water intake of pregnant women but > 0.05 in the case of water intake of lactating women, which stated that there was a significant difference between the collected data on calorie intake before and after three months.

**Table 5**
**Dietary Evaluation (Calories And Water Intake) in Control and Interventional Group**

| **Control** | | **Value** | **df** | **Significance (2-sided)** |
|---|---|---|---|---|
| **Pregnant or Lactating (Calories)** | | | | |
| Pregnant | Pearson Chi-Square | 169.419 | 104 | .000[a] |
| Lactating | Pearson Chi-Square | 48.595 | 20 | .000[a] |
| **Pregnant or Lactating (water))** | | | | |
| Pregnant | Pearson Chi-Square | 66.780 | 30 | .000[a] |
| Lactating | Pearson Chi-Square | 10.000 | 9 | .350[a] |
| **Interventional** | | | | |
| **Pregnant or Lactating (Calories)** | | | | |
| Lactating | Pearson Chi-Square | 12.621 | 12 | .397[a] |
| Pregnant | Pearson Chi-Square | 247.812 | 126 | .000[a] |
| **Pregnant or Lactating (Water Intake)** | | | | |
| Lactating | Pearson Chi-Square | 22.404 | 12 | .033[a] |
| Pregnant | Pearson Chi-Square | 63.559 | 30 | .000[a] |

To assess the dietary evaluation (calories and water intake) in the control and interventional group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. The level of significance was taken as ≤ 0.05. As per Table 4, results showed significance ≤ 0.05 in calorie intake of both pregnant and lactating women and water intake of pregnant, which stated that there was a significant difference between the collected data on dietary evaluation before and after three months.

## Pre-Consumption And Post-Consumption LNS Anthropometric Measurements

We use the Pearson chi-square test to assess the anthropometric measurements (Height, Weight, BMI, and MUAC) in the control group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. The level of significance was taken as ≤ 0.05. As per Table 4.34, my results showed significance ≤ 0.05, which stated that there was a significant difference between the weight, height, and MUAC of the pregnant women's collected data on anthropometric measurements (Height, Weight, BMI, and MUAC) before and after three months.

**Table 6**
**Anthropometric Measurements (BMI, Height, Weight, MUAC) in Control and interventional Group**

| **Control** Pregnant or Lactating (BMI) | | Value | df | Significance (2-sided) |
|---|---|---|---|---|
| Pregnant | Pearson Chi-Square | 2520.000 | 2450 | .159[a] |
| Lactating | Pearson Chi-Square | 345.000 | 324 | .202[a] |
| **Pregnant or Lactating (Height)** | | | | |
| Pregnant | Pearson Chi-Square | 2760.000 | 2116 | .000[a] |
| Lactating | Pearson Chi-Square | 320.000 | 256 | .004[a] |
| **Pregnant or Lactating (Weight)** | | | | |
| Pregnant | Pearson Chi-Square | 2603.000 | 2392 | .001[a] |
| Lactating | Pearson Chi-Square | 280.000 | 272 | .356[a] |
| **Pregnant or Lactating (MUAC)** | | | | |
| Pregnant | Pearson Chi-Square | 1851.667 | 1763 | .069[a] |
| Lactating | Pearson Chi-Square | 246.667 | 224 | .143[a] |
| **Pregnant or Lactating (BMI)** | | | | |
| Lactating | Pearson Chi-Square | 285.000 | 272 | .282[a] |
| Pregnant | Pearson Chi-Square | 2640.000 | 2548 | .100[a] |
| **Interventional Pregnant or Lactating (Height)** | | | | |
| Lactating | Pearson Chi-Square | 300.000 | 225 | .001[a] |
| Pregnant | Pearson Chi-Square | 2940.000 | 2500 | .000[a] |
| **Pregnant or Lactating (Weight)** | | | | |
| Lactating | Pearson Chi-Square | 340.000 | 324 | .260[a] |
| Pregnant | Pearson Chi-Square | 2930.000 | 2856 | .164[a] |
| **Pregnant or Lactating (MUAC)** | | | | |
| Lactating | Pearson Chi-Square | 265.000 | 255 | .320[a] |
| Pregnant | Pearson Chi-Square | 1966.667 | 1845 | .024[a] |

The Pearson chi-square test to assess the anthropometric measurements (Height, Weight, BMI, and MUAC) in control and interventional group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. As per Tab 5, results showed significance ≤ 0.05, which stated that there was a significant difference between the height and MUAC of the pregnant women's collected data on anthropometric measurements (Height, Weight, BMI, and MUAC) before and after three months.

## Pre-Consumption and Post-Consumption LNS Complete Blood Count

We use the paired sample t-test to assess the complete blood count (WBC, RBC, HGB, PLT, and HCT) in the control group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. The level of significance was taken as ≤ 0.05. As per Table 6, results showed significance ≥ 0.05, p = .435 for WBC, 0.060 for RBC, 0.876 for HGB, and 0.735 for PLT which stated that there was no significant difference between the collected data, p = 0.013 for HCT which stated that there was a significant difference between the collected data, on complete blood count (WBC, RBC, HGB, PLT, and HCT) before and after three months.

**Table 7**
**Complete Blood Count (WBC, RBC, HGB, PLT, HCT) In Control and Interventional Group**

| **Control** | | **Paired Differences** | | | | | **t** | **df** | **Sig. (2-tailed)** |
|---|---|---|---|---|---|---|---|---|---|
| | | **Mean** | **Std. Deviation** | **Std. Error Mean** | **95% CI** | | | | |
| | | | | | **Lower** | **Upper** | | | |
| Pair 1 | WBC (Pre) - WBC (post) | .0850 | .9685 | .1083 | -.1305 | .3005 | .785 | 79 | .435[a] |
| Pair 2 | RBC (Pre) - RBC (post) | -.06450 | .30176 | .03374 | -.13165 | .00265 | -1.912 | 79 | .060[a] |
| Pair 3 | HGB (Pre) - HGB (post) | .0125 | .7136 | .0798 | -.1463 | .1713 | .157 | 79 | .876[a] |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pair 4 | PLT (Pre) - PLT (post) | -1.3875 | 36.5480 | 4.0862 | -9.5209 | 6.7459 | -.340 | 79 | .735[a] |
| Pair 5 | HCT (Pre) - HCt (post) | -.49362 | 1.72987 | .19341 | -.87859 | -.10866 | -2.552 | 79 | .013[a] |
| **Interventional** | | | | | | | | | |
| Pair 1 | WBC (Pre) - WBC (post) | .338 | 1.412 | .158 | .023 | .652 | 2.137 | 79 | .036[a] |
| Pair 2 | RBC (Pre) - RBC (post) | -.089 | .321 | .036 | -.161 | -.018 | -2.493 | 79 | .015[a] |
| Pair 3 | HGB (Pre) - HGB (post) | -.521 | .643 | .072 | -.664 | -.378 | -7.256 | 79 | .000[a] |
| Pair 4 | PLT (Pre) - PLT (post) | 2.038 | 33.585 | 3.755 | -5.436 | 9.511 | .543 | 79 | .589[a] |
| Pair 5 | HCT (Pre) - HCt (post) | -1.288 | 4.705 | .526 | -2.335 | -.241 | -2.448 | 79 | .017[a] |

To assess the complete blood count (WBC, RBC, HGB, PLT, and HCT) in control and interventional group of both lactating and pregnant women of the 2nd and 3rd trimesters receiving LNS. . As per Table 6, results showed significance ≥ 0.05, p = 0.589 for PLT which stated that there was no significant difference between the collected data, p = 0.017 for HCT, 0.000 for HGB, 0.015 for RBC, and p = 0.036 for WBC which stated that there was significant difference between the collected data, on complete blood count (WBC, RBC, HGB, PLT, and HCT) before and after three months.

## Comparison of Control And Interventional Group

We use the paired sample t-test to compare the anthropometric measurements in the control and interventional groups to find the effectiveness of LNS intake. The level of significance was taken as ≤ 0.05. As per Table 4.38, my results showed a significance p-value > 0.05, which stated that there was no significant difference between the control group not taking LNS and the interventional group taking LNS.

**Table 8**
**Comparison of Anthropometric Measurements Between Control and Interventional Group**

| | | Paired Differences | | | | | t | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% CI Difference Lower | 95% CI Difference Upper | | |
| Pair 1 | Height (post) - Height (post) | 1.2075 | 8.7711 | .9806 | -.7444 | 3.1594 | 1.231 | .222a |
| Pair 2 | Weight (post) - Weight (post) | 2.0325 | 19.5069 | 2.1809 | -2.3085 | 6.3735 | .932 | .354a |
| Pair 3 | BMI (post) - BMI (post) | .0463 | 7.5800 | .8475 | -1.6406 | 1.7331 | .055 | .957a |
| Pair 4 | MUAC (post) - MUAC (post) | .0963 | 5.9319 | .6632 | -1.2238 | 1.4163 | .145 | .885a |
| **Comparison of Complete Blood Count Between Control and Interventional Group** | | | | | | | | |
| Pair 1 | WBC (post) - WBC (post) | -.1875 | 2.1116 | .2361 | -.6574 | .2824 | -.794 | .429[a] |
| Pair 2 | RBC (post) - RBC (post) | .00800 | .61226 | .06845 | -.12825 | .14425 | .117 | .907[a] |
| Pair 3 | HGB (post) - HGB (post) | -.4200 | 2.1616 | .2417 | -.9010 | .0610 | -1.738 | .086[a] |
| Pair 4 | PLT (post) - PLT (post) | 1.9000 | 83.8529 | 9.3750 | -16.7605 | 20.5605 | .203 | .840[a] |
| Pair 5 | HCt (post) - HCt (post) | -.1700 | 5.8213 | .6508 | -1.4655 | 1.1255 | -.261 | .795[a] |

To compare the anthropometric measurements in the control and interventional groups to find the effectiveness of LNS intake. As per Table 7, results showed a significance p-value > 0.05, which stated that there was no significant difference between the control group not taking LNS and the interventional group taking LNS. To compare the complete blood count (WBC, RBC, HGB, PLT, and HCT) in the control and interventional group to find the effectiveness of LNS intake. The level of significance was taken as ≤ 0.05. As per Table

4.39, my results showed significance ≥ 0.05, p = 0.086 for HGB which stated that there was a significant difference between the control group not taking LNS and the interventional group taking LNS.

## Discussion

As a normal pregnancy progresses, plasma volume gradually rises. The majority of this 50 percent rise happens by week 34 of pregnancy and is proportionate to the baby's birth weight. Hemoglobin concentration, hematocrit, and red blood cell count decrease due to the plasma volume being larger than the growth in red blood cell mass. During a typical pregnancy, the platelet count gradually declines, albeit it typically stays within acceptable ranges. By term, the count will rise to 100-150 109 cells/l in a fraction of women (5–10 percent) (Soofi et al., 2022)..

Maternal undernutrition, characterized by persistent energy and micronutrient deficits, is a pervasive concern globally. However, it is particularly severe in south-central Asia, where more than 10 percent of women aged between 15 and 49 have heights that are below 145 cm. The prevalence of maternal undernutrition, defined as a body mass index below 18 kg/m2, ranges from 10 percent to 19 percent among mothers worldwide (Black at al., 2008). To improve population health and nutritional status, it has been proposed that SQ-LNS could be advantageous. The successful implementation of SQ-LNS treatments, particularly among those who require them the most, necessitates meticulous planning. SQ-LNS interventions have the potential to significantly enhance the nutritional health of vulnerable groups. A nutritional supplementation program known as LNS-MQ was implemented in Pakistan to provide essential nutrients to children aged 6-23 months. To further support this initiative, behavior change communication messages were targeted towards mothers. The program was integrated into Pakistan's primary healthcare system by the Lady Health Worker (LHW) program under the government's jurisdiction (FANTA, 2023).

The objective of this investigation was to ascertain the degree of micronutrient insufficiency in expectant and nursing mothers via the utilization of anthropometric measurements and biomedical evaluations. In addition, the inquiry aimed to appraise the efficacy of Lipid-Based Nutrient Supplements (LNS-PLW) in pregnant and lactating mothers utilizing the same methods. To achieve this, a structured research proforma, known as the 'Nutritional Assessment Form', was devised to document all demographic variables, information about the physical examination, psychological complications, dietary history, anthropometric data, and complete blood count (CBC) outcomes.

Pearson chi-square testing in the psychological complications like anxiety, depression, and headache which stated that women in the control group who weren't receiving LNS and women who were receiving LNS had significant differences in psychological complications. Another study supported the results, it was conducted by Stewart et al. (2015) which stated that LNS was not associated with the psychosocial stress outcomes in pregnant women by using perceived stress scores. However, it was also found that stress can be the risk factor for newborn stunting and Low birth weight in pregnant women. In physical examination that includes skin, hair, nails, and eyes, in both the control and interventional groups. In the control group, there was a significant difference p value ≤ 0.05, in the physical condition of both lactating and pregnant women in 3 months. However, improvement was noticed in the skin, nails, and hairs, while no significant improvement was noticed in eye redness and dry membranes in both lactating (p-value ≤ 0.076) and pregnant (≤ 0.221) women of the interventional group receiving LNS (Stewart et al., 2015).

The dietary evaluation (calorie intake of 24 hours and water intake) of both the control and interventional groups over 3 months using Pearson chi-square testing. There was an improvement in the calorie intake of the control group, while there was no significant

improvement in the water intake of lactating (p-value ≤ 0.350) in the control group. Whereas there was a significant improvement in the calorie and water intake of pregnant women (p-value ≤ 0.000), a slight improvement was seen in the water intake of lactating women (p-value ≤ 0.05) in the interventional group taking LNS. Isanaka et al. (2019) stated that LNS is a good formulation for supporting the nutritional requirements of pregnant women. It was a study of 14 days duration. However, also suggested to add the formulations intake calculations, time of intake during different seasons, longer duration, and conditions in further research. Thus, we examined the 2nd and 3rd trimesters of pregnant women and lactating women consuming LNS side by side and also analyzed the data over 3 months (Isanaka et al., 2019; Malik at al., 2025].

Anthropometric measurements including BMI, height, weight, and MUAC of both lactating and pregnant women in control and interventional groups was analyzed. The analysis showed that there was a significant height difference (p-value ≤ 0.000) and weight of pregnant women (p-value ≤ 0.001) in the control group. Whereas in the interventional group consuming LNS supplements, there was a significant difference in MUAC of pregnant women (p-value = 0.024) as well as the height of pregnant and lactating women (p-value ≤ 0.000). According to the research conducted by Matias et al. (2016), the supplementation of LNS-PL during pregnancy did not exhibit a significant impact on maternal weight gain or MUAC in the entire sample by 36 weeks of gestation. However, the study found that among multifarious women aged 25 years or older, the administration of LNS-PL resulted in increased maternal weight gain during pregnancy. Furthermore, regardless of parity, LNS-PL was found to have a significant, albeit modest, effect on MUAC among women in the same age group, as well as those who had attained height in the lowest quartile of the distribution [18].

The blood count of pregnant and lactating women of both the control and interventional groups was analysed. A significant difference was observed in HCT (p-value = 0.013), while no significant difference was observed in the RBC, WBC, HGB, and PLT p-value of testing (p-value > 0.05). While in the interventional group receiving the LNS, there was a significant difference in WBC (p-value = 0.036), WBC (p-value = 0.015), HGB (p-value ≤ 0.000), and HCT (p-value = 0.017).

The last and most important analysis was the comparison of anthropometric measurements and complete blood count between the control group and interventional group to assess the effectiveness of lipid-based nutrient supplements in pregnant or lactating women receiving LNS. I performed a paired sample t-test to analyze the data. A significant difference was found in the HGB levels (p-value = 0.086) of women in the control and interventional group suggesting that lipid-based nutrient supplements are effective in anemic women or women with low HGB count during pregnancy and lactation. However, there was no significant difference in anthropometric measurements in both control and interventional groups. According to Tariq at al. (2021), pregnant women consuming lipid-based nutritional supplements did not have any difference in concentrations of hematocrit, MCV, and hemoglobin or any anthropometric measures. However, the major limitation of their study was the smaller sample size, as well as the shorter duration of follow-ups in the study (Tariq et al., 2021; Ancira-Moreno at al., 2025). In our study, we took a larger sample size with 2nd and 3rd trimesters of pregnancy and also included the effects of consuming the LNS in lactating women. Our results also stated that HGB count is affected by taking LNS in pregnant women which was contrary to the previous research (Matias at al., 2016).

## Conclusion

Based on our research, we have discovered that pregnant and lactating women from low socioeconomic backgrounds are often plagued by nutritional deficiencies. Our conclusion was based on careful analysis of their physical assessments, anthropometric parameters, and dietary habits. Interestingly, we found that those who supplemented their

diet with lipid-based nutritional supplements during their 2nd and 3rd trimester of pregnancy enjoyed improved nutritional status before and after taking the supplements. This suggested that LNS may offer benefits to women experiencing low HGB count due to nutritional deficiencies or anemia during pregnancy or lactation and is recommended to women in pregnancy and during lactation.

**Recommendations**

This study recommended that for pregnant and lactating women nutritional supplements should be added in their routine care. Health agencies and government ensure accessibility and promote awareness for the pregnant and lactating women and Collective efforts between international health agencies, Government and NGOs are essential to sustainably combat of maternal malnutrition. The further researchers can investigate long term consequences effect with digital strategies.

## References

Ancira-Moreno, M., & Hernández-Cordero, S. (2025). Challenges, opportunities, and actions for improved maternal and child nutrition. *Frontiers in Nutrition*, *12*, 1580113.

Benazir Nashonuma Program Ehsaas 8171. (2013). Retrieved from https://ehsaas8171.com/benazir-nashonuma-program/

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., De Onis, M., Ezzati, M., ... & Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The lancet*, *371*(9608), 243-260. https://doi.org/10.1016/s0140-6736(07)61690-0

Evidence and Programmatic Considerations for the Use of Small Quantity Lipid-Based Nutrient Supplements for the Prevention of Malnutrition | Food and Nutrition Technical Assistance III Project (FANTA). (n.d.). Retrieved July 30, 2023, from www.fantaproject.org website: https://www.fantaproject.org/research/prevention-of-malnutrition/meeting-highlights-sqlns-malnutrition

Gera, T., Pena-Rosas, J. P., Boy-Mena, E., & Sachdev, H. S. (2017). Lipid based nutrient supplements (LNS) for treatment of children (6 months to 59 months) with moderate acute malnutrition (MAM): A systematic review. *PloS one*, *12*(9), e0182096. https://doi.org/10.1371/journal.pone.0182096

Isanaka, S., Kodish, S. R., Mamaty, A. A., Guindo, O., Zeilani, M., & Grais, R. F. (2019). Acceptability and utilization of a lipid-based nutrient supplement formulated for pregnant women in rural Niger: a multi-methods study. *BMC nutrition*, *5*(1), 34. https://doi.org/10.1186/s40795-019-0298-3

Jiang, S., Liu, J., Qi, X., Wang, R., Wang, X., Wang, K., … Shan, L. (2022). Global, Regional, and National Estimates of Nutritional Deficiency Burden among Reproductive Women from 2010 to 2019. *Nutrients*, *14*(4), 832. https://doi.org/10.3390/nu14040832

Khayat, S., Fanaei, H., & Ghanbarzehi, A. (2017). Minerals in pregnancy and lactation: a review article. *Journal of clinical and diagnostic research: JCDR*, *11*(9), QE01. https://doi.org/10.7860/jcdr/2017/28485.10626

Kominiarek, M. A., & Rajan, P. (2016). Nutrition recommendations in pregnancy and lactation. *The Medical Clinics of North America*, *100*(6), 1199. https://doi.org/10.1016/j.mcna.2016.06.004

Liao, J. B., Buhimschi, C. S., & Norwitz, E. R. (2005). Normal labor: mechanism and duration. *Obstetrics and Gynecology Clinics*, *32*(2), 145-164. https://doi.org/10.1016/j.ogc.2005.01.001

Matias, S. L., Mridha, M. K., Rina Rani Paul, Hussain, S., Vosti, S. A., Arnold, C. D., & Dewey, K. G. (2016). Prenatal Lipid-Based Nutrient Supplements Affect Maternal Anthropometric Indicators Only in Certain Subgroups of Rural Bangladeshi Women. *The Journal of Nutrition*, *146*(9), 1775–1782. https://doi.org/10.3945/jn.116.232181

Meyers, L. D., Hellwig, J. P., & Otten, J. J. (Eds.). (2006). *Dietary reference intakes: the essential guide to nutrient requirements*. National Academies Press.

Muhammad, S., Malik, A. A., Soofi, S., Habib, A., Umer, M., Rizvi, A., ... & Bhutta, Z. A. (2025). Impact assessment of Benazir Nashonuma Programme (BNP) on maternal, child health

and nutritional status in Pakistan: a quasi-experimental study protocol. *BMJ open*, *15*(6), e094565. .

Pakistan National Nutrition Survey (2018). Key Findings Report - Pakistan | ReliefWeb. (2019, June) Retrieved August 3, 2023, from reliefweb.int

Sher, N., Mubaraki, M. A., Zafar, H., Nazli, R., Zafar, M., Fatima, S., & Fozia, F. (2022). Effect of Lipid-Based Multiple Micronutrients Supplementation in Underweight Primigravida Pre-Eclamptic Women on Maternal and Pregnancy Outcomes: Randomized Clinical Trial. *Medicina*, *58*(12), 1772. https://doi.org/10.3390/medicina58121772

Soma-Pillay, P., Nelson-Piercy, C., Tolppanen, H., & Mebazaa, A. (2016). Physiological changes in pregnancy. *Cardiovascular Journal of Africa*, *27*(2), 89–94. https://doi.org/10.5830/cvja-2016-02

Soofi, S. B., Khan, G. N., Ariff, S., Ihtesham, Y., Tanimoune, M., Rizvi, A., … Bhutta, Z. A. (2022). Effectiveness of nutritional supplementation during the first 1000-days of life to reduce child undernutrition: A cluster randomized controlled trial in Pakistan. *The Lancet Regional Health - Southeast Asia*, *4*, 100035. https://doi.org/10.1016/j.lansea.2022.100

Stewart, C. P., Oaks, B. M., Laugero, K. D., Ashorn, U., Harjunmaa, U., Kumwenda, C., … Dewey, K. G. (2015). Maternal cortisol and stress are associated with birth outcomes, but are not affected by lipid-based nutrient supplements during pregnancy: an analysis of data from a randomized controlled trial in rural Malawi. *BMC Pregnancy and Childbirth*, *15*(1). https://doi.org/10.1186/s12884-015-0793-8

Tariq, K., Fatima, S., Nazli, R., Habib, S. H., & Shah, M. (2021). Impact Of Lipid-Based Nutritional Supplementation In Primi-Gravidas And Its Effect On Maternal, Birth And Infant Outcomes: A Randomized Controlled Trial. *Khyber Medical University Journal*, *13*(4), 187–192. https://doi.org/10.35845/kmuj.2021.21913

World Food Program Pakistan (2022). Country Brief, January 2022 - Pakistan | ReliefWeb. (2022, February 25). Retrieved August 4, 2023, from reliefweb.int website: https://reliefweb.int/report/pakistan/wfp-pakistan-country-brief-january-2022