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# Impact of socioeconomic and education level on nutritional status of pregnant mothers

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## ABSTRACT

**Objectives:** Upgrading maternal nutrition is the best approach to improving women's health and their infants. Particularly in low-income nations like Sri Lanka, a complicated mix of socioeconomic factors affects pregnant women's health. Reliable information on the nutritional status of pregnant mothers and the effects of socioeconomic status (SES) is lacking as a result of the internal conflict situation that has existed in Sri Lanka for more than 30 years, particularly in the Batticaloa region. Therefore, this study was conducted to ascertain the impact of SES and educational attainment on the nutritional status of pregnant mothers in the Batticaloa district.

**Material and Methods:** A population-based cross-sectional study, which included 382 pregnant mothers who attended the antenatal clinics of the Ministry of Health in the Batticaloa district, was considered in the present study. Pre-tested questionnaires were used to collect information regarding the SES of pregnant mothers. Anthropometric measurements and biochemical parameters of the pregnant mothers were also measured. The Multiple Logistic Regression model was used to evaluate the major socioeconomic factors that influence nutritional status.

**Results:** According to the findings, education positively influences the pregnant mother's body mass index (BMI), body fat percentage, and serum ferritin level ($P < 0.05$), but age, family size, monthly income, and occupation had no significant impact on the ferritin level of the pregnant mothers. Lower education levels, such as primary education (Odds ratio [OR] = 0.203) and completed up to grade nine (OR = 0.211), show low ferritin levels. Mothers working in the government sector (OR = 1.236) and the business field (OR = 1.334) have more chances of being prediabetes.

**Conclusion:** Socioeconomic parameters such as age and the occupation of pregnant mothers positively influenced their BMI. Age, level of education, and occupation have also increased the body fat percentage of the pregnant. The fasting serum glucose level increases with increasing the income level and the type of occupation; therefore, to enhance the nutritional health of pregnant mothers, good nutritional counseling and knowledge is crucial.

**Keywords:** Ferritin, Hemoglobin, Pregnant mothers, Nutritional status, Socioeconomic status

## INTRODUCTION

Malnutrition is the most important risk factor for maternal and child health.[1] Hence, upgrading maternal nutrition is one of the best ways to enhance the health of women and their offspring. A wide range of socioeconomic factors affect pregnant women's health in low-income countries.[2] Further, socioeconomic variables are critical determinants of nutrient consumption and the quality of diets.[3] People with low socioeconomic status (SES) typically experience nutritional deficiencies, which are more likely to involve numerous than single deficiencies.[4] SES has been shown by many studies to be related to almost all health conditions and their risk factors. Price and the diversity of diets have a significant impact on meal choices. Since they are more expensive, these foods are

frequently avoided from the diet. According to Finch,[5] low income is a socioeconomic condition that is frequently linked to unhealthy eating. Women may not be able to afford healthy, nourishing food during pregnancy due to their low financial resources.[6] Pregnant women with low-income frequently consume fewer fruits and vegetables.[7,8] This eating pattern may result in reduced intake of macronutrients, vitamins, and minerals as well as low infant birth weight.[7,8]

Numerous studies have found that poor income can result in stress and depression, as well as riskier health and nutritional status of pregnant mothers.[9,10] Conversely, positive health behaviors are linked with social support and family care.[10] In the Batticaloa district of Sri Lanka, reliable data on the socioeconomic factors affecting the nutritional status of pregnant mothers are absent due to the internal conflict over the past 30 years. Therefore, there is a need for updated data on this important health problem to solve the issues. In this view, this study was conducted to find the effect of socioeconomic and educational status on the nutritional status of pregnant mothers in the Batticaloa district.

## MATERIAL AND METHODS

### Study location and sample selection

A cross-sectional study based on the population was carried out. For this study, seven divisional secretariats divisions in the Batticaloa District of Sri Lanka's Eastern Province were chosen. The study population consisted of pregnant women who attended prenatal clinics run by the Ministry of Health (MOH) from the Batticaloa District. The subjects were selected from the sampling frames of the clinics obtained from the office of the MOH. The purpose of the study was explained to the selected subjects, and provided the consent forms consisted of study details and information about blood collection. Then, the participants of the study were screened by measuring their erythrocyte sedimentation rate (ESR) to eliminate those who had any subclinical infections (ESR higher than 25 mm/h). Finally, 382 healthy pregnant women between the ages of 15 and 49 who were in the second trimester were chosen. Out of those who agreed to participate in the study, pregnant mothers having chronic diseases such as hypertension (09) and diabetes (11) were excluded from the study. The ethical clearance for this study was obtained from the Ethical Committee of the Eastern University, Sri Lanka (EUSL/FHCS/ERC/2013/08).

### Collection of information on socioeconomic factors and the nutritional status of pregnant mothers

Before conducting the survey, the interview questionnaire was pretested using ten pregnant mothers for reliability and validity for that, and the food frequency questionnaire was prepared with different food items available in the district and pre-tested with ten subjects, including six Tamils and four Muslims pregnant mothers attending the antenatal clinic (ANC) to gather general information and dietary information. Finally, the questionnaire was modified with the final list of food items and related information according to the responses given by them. Pre-tested questionnaires were used to collect the information, including socio economic status such as age, ethnicity, family size, monthly income, occupation, and education of the pregnant mothers. For the anthropometric measurements, a physician scale (Detecto, USA) was used to assess each subject's bodyweight throughout the second trimester of gestation (14–26 weeks) with an accuracy of 0.1 kg. A wall-mounted stadiometer was used to measure the barefooted subjects' height in centimeters (Doherty, UK). The measurements were read to the nearest 0.1 cm with the eye level rod. Warrior body mass calipers were used to take precise measurements of the participants' body fat percentage (Sequoia fitness products, USA). Skinfold measurements are taken on the right side of the body while standing upright and relaxed. Based on the height and weight of the subjects, body mass index (BMI) was calculated as weight/height$^2$ (kg/m$^2$). BMI cut points for Asians used to categorized as underweight (<18.5 kg/m$^2$), healthy weight (18.5–22.99 kg/m$^2$), overweight (23–27 kg/m$^2$), and obese (≥27 kg/m$^2$) (World Health Organization Expert consultation, 2004). After a 12-h fast, fasting venous blood (5 mL) was collected from individuals in the second trimester by venipuncture. Blood was collected into plain (serum) redtop tubes and green top ethylenediaminetetraacetic acid tubes at the ANC by the nurse. Moreover, the serum was separated using a bench top centrifuge (Gemmy, Taiwan) by centrifuging the red top tube with drawn blood for five minutes at 3000 rpm. Separated serum was stored at −20°C until the estimation of serum ferritin. Serum glucose was determined by the glucose oxidase method using a glucose enzymatic kit from Randox laboratories, England. Hemoglobin was estimated by the cyanmethemoglobin method, and the enzyme-linked immunosorbent assay was used to determine the serum ferritin of pregnant mothers.

### Statistical analysis

The general characteristics of pregnant mothers were described using frequency analysis. Multivariate studies using logistic regression were used to identify the relationship between socioeconomic characteristics and the nutritional status of pregnant women. $P = 0.05$ was used to define statistical significance for all two-sided statistical tests.

## RESULTS

### Demographic characteristics of pregnant mothers

Table 1 describes the age, family size, educational level, occupation, monthly income, and ethnicity of the

participating mothers in the study. The mothers included in the study were in the age range of 15–49 years and a mean age of 26.6 (standard deviation [SD] ± 5.7) years. The majority (85.3%) of the women were between 20 and 35 years of age. The study covered 56% of Tamils and 44% of Muslims. The family size of the studied samples was found to be 2–6, with a mean size of 3.0 (SD ± 1.0).

It also revealed that improvements in sanitation and female education were associated with a reduction in anemia among pregnant women (15–49 years old) (NFHS, 2015–2016). The pregnant mothers were employed in a variety of occupations. Most of them (58.2%) were housewives, 17.0% worked in the private sector, 12.3% were working in the government sectors, 7.6% were farmers, and 4.9% were employed in other occupations. According to this study, 39.3%, 25%, 8.1%, and 2.4% of the pregnant mothers were from families earning between Rs. 5,000 and Rs. 15,000, Rs. 25,000 and Rs. 35,000, and Rs. 35,000 and Rs. 50,000, respectively. The remaining were made more than Rs. 50,000.

**Table 1:** Demographic characteristics of pregnant mothers.

| | Frequency | Percentage |
|---|---|---|
| Age | | |
| 15–19 | 31 | 8.1 |
| 20–35 | 326 | 85.3 |
| 36–49 | 25 | 6.6 |
| Family size (members) | | |
| 2 | 142 | 37.2 |
| 3 | 118 | 30.9 |
| 4 | 88 | 23.0 |
| 5 | 27 | 7.1 |
| 6 | 7 | 1.8 |
| Educational level | | |
| Primary | 38 | 9.9 |
| Grade 6–9 | 120 | 31.4 |
| Grade 9-O/Level | 123 | 32.2 |
| A/Level | 88 | 23 |
| Degree | 13 | 3.4 |
| Occupation | | |
| Government job | 47 | 12.3 |
| Non-government organizations | 19 | 4.9 |
| Housewives | 222 | 58.2 |
| Business | 65 | 17 |
| Agriculture and farming | 29 | 7.6 |
| Monthly family income | | |
| 5000 and below | 96 | 25.1 |
| 5001–15,000 | 150 | 39.3 |
| 15,001–25,000 | 90 | 23.6 |
| 25,001–35,000 | 31 | 8.1 |
| 35,001–50,000 | 9 | 2.4 |
| 50,001 and above | 6 | 1.6 |
| Ethnicity | | |
| Tamil | 214 | 56 |
| Muslim | 168 | 44 |

**Effects of Socioeconomic parameters on pregnant mother's nutritional status**

The binary logistic regression model and multinomial logistic regression model were used to investigate whether the socioeconomic parameters such as age, family size, ethnicity, education level, occupation, and monthly income influenced the nutritional status of pregnant mothers in the study area.

Table 2 depicts the multinomial logistic model estimates of several socioeconomic variables against a pregnant mother's BMI. It is shown that the age of a pregnant mother, her underweight relative to normal BMI is reduced by 0.916 units, as well as a pregnant mother being overweight and obese relative to normal BMI is increased by 1.084 and 1.113 units, respectively, while considering all other predictors constant in the model. The results further, showed that the pregnant mother's BMI increased with their age ($P < 0.05$). This might be caused by biological changes in the body and declining physical activity with the age.[11] A similar finding was observed in Pakistan[12] and Namibia.[13]

From the OR of pregnant mothers' education, compared to the mothers with advanced level education, the mothers with primary and secondary education are 7.276 and 1.610 times more likely to be underweight than average BMI, respectively.

A multinomial logistic model was used to analyze the influences of socioeconomic factors on the body fat percentage of pregnant mothers in the second trimester. Table 3 shows that the chance of being in low body fat over the normal body fat is increased by 1.674 and 4.332 for

**Table 2:** Estimated effects of socioeconomic parameters on pregnant mother's BMI.

| Variables | OR (*P*-value) | Lower bound | Upper bound |
|---|---|---|---|
| Underweight (<18.5 kg/m$^2$) | | | |
| Age | 0.916 (0.03) | 0.846 | 0.991 |
| Occupation | | | |
| Housewives | 0.352 (0.032) | 0.136 | 0.916 |
| Fishing (ref) | 1 | | |
| Education | | | |
| Primary | 7.276 (<0.001) | 1.783 | 29.686 |
| Up to grade 9 | 1.610 (<0.001) | 0.655 | 3.958 |
| A/L (ref) | 1 | | |
| Overweight (23–27 kg/m$^2$) | | | |
| Age | 1.084 (0.013) | 1.017 | 1.156 |
| Occupation | | | |
| Business | 5.076 (0.04) | 1.073 | 24.019 |
| Fishing (ref) | 1 | | |
| Obese (≥27 kg/m$^2$) | | | |
| Age | 1.113 (0.002) | 1.042 | 1.19 |

Normal BMI (18.5–22.9 kg/m$^2$) is set as a reference for this model.
Ref: Reference, OR: Odd ratio, α=0.05, BMI: Body mass index, A/L: Advance level

mothers with primary and secondary education, respectively, compared to the mothers with advanced level education. This confirms the previous reasoning of a positive influence of education on dietary behavior. The result of this analysis shows that a unit increase in the age of pregnant mothers increases the chance of being in the category of high body fat percentage over the normal body fat percentage by 1.089 times. If the pregnant mothers work in the non-governmental organizations and the business field, they have 6.401 units and 5.028 units more chance of having a high fat percentage in their body relative to normal body fat percentage.

Table 4 shows the relationship between socioeconomic factors and the serum ferritin of pregnant mothers. The multinomial logistic model revealed that except for the education level, other socioeconomic factors such as age, family size, monthly income, and occupation had no significant impact on the ferritin level of the pregnant mothers.

The pregnant mothers who have lower education levels, such as primary education (OR = 0.203) and completed up to grade nine (OR = 0.211), have more chance of having low ferritin levels in their blood than the mothers who have completed the advanced level education. The above analysis has shown the positive impact on the serum ferritin level by increasing pregnant mothers' education level.

## DISCUSSION

### Impact of education level on nutritional status of pregnant mothers

In this study, the educational level of the participants was low. According to Adikari *et al.*,[14] one of the potential risk factors for poor nutritional status is low educational background. Less than one-third of the study population (32.0%) completed the ordinary level education (mid-way secondary), and only 3.4% completed their tertiary education. Almost all the rural areas in the district were affected by an internal civil war until 2009, and people in this area lost their assets and became economically unstable. The majority of pregnant ladies reported that their precarious economic status forced them to leave school and get married when they were younger. It is obvious that the majority of these mothers possess low nutrition literacy status; therefore, educating mothers on nutrition may help them to improve their health and nutritional status. According to the National Family Health Survey (201516) in India, anemic pregnant women are more likely to die or deliver low-birth-weight babies, increasing the risk of the infant's death. It also revealed that improvements in sanitation and female education were associated with a reduction in anemia among pregnant women (1549 years old) (NFHS, 20152016).

A healthy lifestyle appears to be influenced by education. According to the findings, education positively influences the pregnant mother's BMI ($P < 0.05$). The awareness of nutritional food increases with the level of education.[15] This might help them to maintain good nutritional status during the pregnancy period. Educated women are autonomous in decision-making and access to household resources, leading to increased BMI and occasionally resulting in obesity.[16]

As far as the effect of occupation on pregnant mothers' BMI is concerned, the pregnant mothers who were housewives being underweight relative to normal BMI are reduced by 0.352 units, whereas the pregnant mothers working in the business field have a 5.076 more chance of becoming overweight compared to normal BMI. These results demonstrate the influence of education and Decision-making on dietary behavior. Other occupations such as government and non-governmental organizations and agriculture farming have a lower possibility of falling in the underweight, overweight, and obese category because women in the above activities require physical engagement. Pregnant mothers who have engaged with the

**Table 3:** Estimated effects of socioeconomic parameters on pregnant mother's body fat percentage.

| Variables | OR (*P*-value) | Lower bound | Upper bound |
|---|---|---|---|
| Low fat percentage | | | |
| Education | | | |
| Primary | 1.674 (<0.001) | 0.213 | 13.157 |
| Up to grade 9 | 4.332 (<0.001) | 0.771 | 24.330 |
| Advance level (ref) | 1 | | |
| High body fat percentage | | | |
| Age | 1.089 (0.002) | 1.033 | 1.148 |
| Occupation | | | |
| NGOs | 6.401 (0.015) | 1.425 | 28.725 |
| Business | 5.028 (0.007) | 1.567 | 16.129 |
| Fishing (ref) | 1 | | |

Normal fat percentage is set as a reference for this model. Ref: Reference, OR: Odd ratio, α=0.05. NGOs: Non Governmental Organizations

**Table 4:** Estimated effects of socioeconomic parameters on pregnant mother's serum ferritin level.

| Variables | OR (*P*-value) | Lower bound | Upper bound |
|---|---|---|---|
| Low ferritin | | | |
| Education | | | |
| Primary | 0.203 (0.042) | 0.44 | 0.945 |
| Up to grade 9 | 0.211 (0.021) | 0.056 | 0.790 |
| Advance level (ref) | 1 | | |

Low: ≤15 ng/mL, Normal: 15–150 ng/mL, Overload: ≥150 ng/mL. Normal serum ferritin is set as a reference for this model. Ref: Reference, OR: Odd ratio, α=0.05

jobs in the Non-Governmental Organizations and doing business have shown a high body fat percentage due to their high-income, which leads them to select wrong food choices such as junk foods and refined cereals rather than nutritious food. However, this shows the decision-making power of the dietary behavior increases with their employment status. The awareness about diet diversity and the food selection related to its nutritional value increases with the level of education and may lead them to eat nutritious food. The serum ferritin levels are considered as the "gold standard" to determine the iron stores in the body under normal situations.[17] In Pakistan, a significant difference was noticed in ferritin levels with age and gender.[18]

### Impact of socio-economic status on the nutritional status of pregnant mothers

The binary logistic model was used to estimate the effects of socioeconomic parameters on the hemoglobin content of the pregnant mothers and the birth weight of their newborns [Table 5]. The result revealed that pregnant mothers from the Muslim community have a 1.95 times more chance to be in normal hemoglobin levels in the blood than those in the Tamil community. Comparatively, the SES of the Muslims is higher than the Tamils, due to this lower SES, Tamils are in vulnerable status in the study area. These findings were consistent with Alemayehu *et al.*,[19] Tadesse *et al.*,[20] have discovered anemia was more common in women from lower socioeconomic classes than from upper classes in Ethiopia. Furthermore, according to Noreen *et al.*,[21] anemia was more common in Pakistan among women in the younger age group (2530 years old) and pregnant women who received low monthly income (20,00040,000 Rs./Month). Therefore, anemia is related to the financial status of pregnant mothers. These investigations made it clear that a low socioeconomic position is associated with inadequate nutrition, which might result in anemia. Family size had an influence on the hemoglobin level of the pregnant mothers. From the family size OR, one unit increase in family size decreases the chance to be normal hemoglobin by 0.681 times (OR = 0.681, $P$ = 0.013). Compared to the mothers working in the government sector, housewives and those who are involved in agriculture-related farming activities showed the risk of delivering low-birth-weight babies. The occupational level, which is linked with educational status, showed the power of decision-making in particular of seeking antenatal care appropriately. It was reported in the previous studies that working and educated women are likely to have antenatal checkups more frequently than less educated mothers.[22]

**Table 5:** Estimated effects of Socioeconomic parameters on pregnant mother's hemoglobin level and their infant's birth weight.

| Variables | OR | *P*-value |
|---|---|---|
| Hemoglobin | | |
| Ethnicity | | |
| Tamils (ref) | 1 | 0.039 |
| Muslims | 1.955 | 0.039 |
| Family size | 0.681 | 0.013 |
| Low-birth-weight (<2.5 kg) | | |
| Occupation | | |
| Government (ref) | 1 | |
| Housewives | 0.169 | 0.022 |
| Farming (agriculture) | 0.171 | 0.025 |

Normal: ≥11 g/dL, Mild: 10–10.9 g/dL, Moderate: 7–9.9 g/dL, Severe: <7 g/dL. Ref: Reference, OR: Odd ratio, α=0.05

## CONCLUSION

Based on the results of the current study, it is concluded that the socioeconomic parameters of education and employment status of pregnant mothers have a positive influence on their nutritional status. Body fat percentage has increased with increasing the age, level of education, and occupation that they have followed. Serum ferritin indicated a positive relationship with pregnant mothers' education level and hemoglobin levels reduced with increasing the family size. Overall, an educational status linked with nutritional literacy status and the ability of decision-making plays a major role in the nutritional status of the study population. Therefore, it is important to identify the barriers that exist and the factors affecting the level of nutritional literacy of pregnant mothers. The study results suggest the importance of conducting regular nutrition counseling and awareness programs targeting pregnant mothers of these underprivileged populations. The health teams responsible for antenatal care must be further strengthened on ways of conveying the significance of healthy nutrition during pregnancy in an effective approach.

### Ethical approval

The research/study is approved by the Institutional Ethics Committee at Eastern University, Sri Lanka, number EUSL/FHCS/ERC/2013/08, dated 13th september 2013.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

**Use of artificial intelligence (AI)-assisted technology for manuscript preparation**

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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