Original Article
DOI: https://doi.org/10.70749/ijbr.v3i1.482

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Maternal Nutrition and Its Impact on Low Birth Weight in Newborns

Sana[1], Irum Sajid[2], Sher Alam Khan[3], Shafqat Hussain[4], Masood Ur Rehman[5], Mian Sohail Adnan[6]

[1]Department of Pediatrics, Ayub Teaching Hospital, Abbottabad, KP, Pakistan.
[2]DHQ Hospital, Abbottabad, KP, Pakistan.
[3]Department of Pediatrics, Musharaf Medical Complex, Abbottabad, KP, Pakistan.
[4]Health Department, Khyber Pakhtunkhwa, Pakistan.
[5]Alkhidmat Hajira Hamza Thalasemia Center, Abbottabad, KP, Pakistan.
[6]Department Pediatrics, Ayub Teaching Hospital, Abbottabad, KP, Pakistan.

ARTICLE INFO

Keywords

Maternal Nutrition, Low Birth Weight, Neonatal Outcomes, Dietary Deficiencies, Micronutrients, Socio-economic Factors, Healthcare Access, Nutritional Interventions.

Corresponding Author: Sher Alam Khan, Senior Registrar Pediatrics, Musharaf Medical Complex, Abbottabad, KP, Pakistan.
Email: doctorsheralamkhan@gmail.com

Declaration

Author's Contributions: All authors equally contributed to the study and approved the final manuscript.
Conflict of Interest: No conflict of interest.
Funding: No funding received by the authors.

Article History
Received: 28-11-2024
Revised: 25-12-2024
Accepted: 01-01-2025

ABSTRACT

Maternal nutrition and its effects on birth weight especially with reference to dietary inadequacy, socio demographic status and health services. Using a mixed-methods approach, data from 300 postpartum women revealed significant nutritional gaps, including insufficient energy (mean intake: Energy (1800 kcal vs. recommended 2500 kcal), protein (45 g vs. 75 g), and micronutrients including iron, calcium, and vitamin D. These deficiencies were strongly associated with LBW, with multivariate regression showing significant odds ratios for energy (AOR: 2.privilege were significantly associated with higher energy intake (AOR: 5.0; 95% CI: 1.6–4.0) and higher protein intake (AOR: 3.1; 95% CI: 1.9–5.2). The study also realized that 33.3% of infants were categorized as LBW, which was similar to the current global statistics of low-income settings. The study affirmatively confirms maternal dietary interventions, use of supplementation, and the improvements in socio-economic wellbeing and its cruciality for decreasing the LBW prevalence. This research gives practical recommendations to both policy makers and health care practitioners who wish to enhance maternal and neonatal health.

INTRODUCTION

LBW, whereby a newborn baby weighs less than 2,500 grams at birth, is a major public health concern in the global world, with around 20 million LBW babies being born annually, especially in LMICs (WHO, 2014). Such infants are at a higher risk of neonatal mortality, cognitive impairment, and adults' chronic diseases such as heart diseases, diabetes and hypertension in adulthood (Barker, 1995). LBW has multiple determinants of which maternal nutrition is central to driving the condition (Kheirouri, S., 2021).

The nutrition of a woman before pregnancy as well as the food consumed by this woman during pregnancy significantly determines fetal development. Maternal nutrition determines placental function and nutrient availability to the fetus with inadequate nutrition frequently leading to IUGR, preterm birth and other poor maternal and neonatal outcomes (Kramer, 1987). Maternal malnutrition is particularly a significant issue in LMICs since many women from these contexts face food insecurity, combined with cultural beliefs and inadequate health care (Black et al., 2013; Engidaw, M. T., 2022).

Deficiency in macronutrient and micronutrient is known to have adverse effects such as LBW in pregnancy. Protein: Required for fetal energy and development of tissues Carbohydrates: Needed for the energy source of fetal metabolism Fat: Macronutrient provides energy for fetal metabolism. Energy deficiency caused by poor caloric intake can lead to fetal size limitation. Other nutrients that have important functions

in fetal development include iron, folic acid, zinc and iodine. For instance, pregnant women with iron deficiency anemia results into lower oxygen delivery to the feti and hence higher odds of LBW continues to persist (Christian et al., 2013). Likewise, lack of folic acid is associated with neural tube defects and perhaps has a disruptive effect on fetal growth (Bhutta et al., 2013). Deficiencies in zinc and iodine, which are rampant in low income settings globally, compromise the cell division and metabolism and thus are confounding factors for LBW (Mohamed, H. J. J.,2022).

The socio-economic and environmental factors have potential effects on the diet of the mothers and consequently the pregnancy outcomes. A sense of self-deprivation is common among low income women who suffer from poor diet quality, limited access to health services, and higher chances of malnutrition all of which raise their chances of bearing LBW infants (Victora et al., 2008). Second, there are cultural taboos and traditions of pregnancy that also reduce nutrient intakes and worsens the situation (Bhutta et al., 2013). Such issues call for appropriate public health interventions especially in the areas of nutrasight, nutrition pharmacotherapy, and enhanced perinatal care (Jana, A., 2023).

This paper aims to review maternal nutrition and LBW in relation to macronutrients; further, it considers socio-economic factors and access to healthcare services in this connection. Through this analysis, this study will underscore the need for aggressive maternal nutrition programmes in order to limit the cases of LBW and enhance neonatal health.

LITERATURE REVIEW

The relationship between maternal nutrition and its bearings on the newborns, in particular, LBW, has been explored in numerous public health as well as clinical studies. Review of literature in the current study confirms that the findings provide overwhelming evidence of the extent to which maternal nutrition influences fetal growth and development. This section discusses LHW causative factors based on macronutrient and micronutrient deficiencies, socio-economic determinants and evaluations of health interventions (Yisahak, S. F.,2021)

Micronutrient deficiencies in women of child bearing age are one of the most probable causes of variation in fetal growth. Protein, carbohydrate and fat otherwise referred to as micronutrients, give the energy and essential raw materials required in the growth of the fetus. Kramer (1987) has argued that deficiencies in the number of calories consumed by pregnant mothers play a central role in IUGR – a leading reason for the development of LBW. The energy deficits due to low energy intake decreases the physical nutrient of the placenta, which unfavourably affects fetal development (Savarino, G., 2021).. The symptoms are worst when the diet lacks proteins since proteins are vital to the growth of fetal tissues and cell division. As pointed by King (2000), lack of protein implies lack of amino acids, and this is why birth sizes appear to be smaller. In the same way, dietary fats and particularly omega 3 fatty acids are important in ensuring that adequate circulation in the placental area and the nutrients should reach the fetus. Makrides et al. (2006) showed that maternal supplementation with omega-3 fatty acid yielded improved birth weights indicating the significance of fat to newborn health (Avnon, T., 2021)

Malnutrition, especially ,limbic prematurity, is another significant cause of LBW Micronutrient deficiency is another important cause of LBW in LMICs. With LBW being the outcome that affects approximately 38% of pregnant women in this global society, Iron deficiency anemia has been found to have very tight relations with this condition (Shinde, S., 2022). Anemia decreases the capability of blood to transport oxygen resulting in decreased delivery of oxygen to the fetus and hence slow fetal growth. Additional, Peña-Rosas et al. (2015) affirmed that the iron administration during the pregnancy also contributed to the decrease of preterm birth besides increasing birth weight. The utilization of iron/folate supplementation also shows reduced risks of LBW in other studies, which has also been known to increase odds of adverse pregnancy outcomes when consumed in inadequate amounts. Folic acid plays a critical role in DNA synthesis and cell division, and low fetal intake of this nutrient results in neural tube defect and stunted fetal growth. In another study, Christian et al. (2013) pointed out that periconceptual folic acid intake enhanced birth weight in the groups of pregnant women with low initial levels of nutrient intake (Lin, J., 2022).

Other nutrients causes include zinc and iodine deficiencies which have been shown to be major causes of LBW. Zinc plays a direct role in cell division and immunologic reaction; iodine is necessary for thyroid hormones synthesis that regulates fetal metabolism and growth. Haider and Bhutta (2012) proved that zinc supplementation contributed to decrease risk of LBW during pregnancy but the effect size was moderate. Again, iodine, which continues to be a problem in many parts of developing nations, has been associated with risks of stillbirth, early preterm delivery and LBW. Zimmermann (2011) points out that supplementation with iodine in an iodine-deficient population optimizes the fetus size and pregnancy complications (Lisco, G.,2023).

Malnutrition and especially lack of intake of calcium and vitamin D are also causes of LBW. Calcium is involved in bone and blood vessel construction and disturbances in calcium balance during pregnancy have been proposed as a possible cause of pre-eclampsia,

which strongly predisposes to LBW. Hofmeyr et al. (2014) have established that calcium supplementation in pregnant women also prevented preeclampsia and related complications. A lack of vitamin D, a condition prevalent among pregnant women in LMICs, has been identified as among the causes of fetal growth restriction. According to Perez-Lopez et al. (2015), vitamin D supplement during pregnancy enhances fetal bone mineralization and birth outcomes excluding the cases of babies with LBW(.Urufia, 2024).

Maternal nutrition and the resultant neonatal outcomes areuyện strongly influenced by socio-economic factors. Food insecurity, poor maternal health care, and high prevalence of malnutrition among women of low economic status boost the occurrence of LBW. Similarly, Victora et al. (2008) showed that status differences, in terms of socioeconomic class, are closely related to differences in maternal nutrition status and birth outcomes. Furthermore, cultural practices and local dietary taboos during pregnancy worsen degrees of malnutrition. For instance, Moser et al. (2005) conducted a cross sectional study in rural India and found almost all pregnant women adhered to food taboos for whatever reason reduced maternal dietary and poor birth outcomes. Another factor is education, therefore among women the level of education determines dietary practices and healthcare use. Smith & Haddad, (2015) made a relation between the increase in maternal education and better neonatal health and nutritional intake showing that inequality has to be addressed (Strobel, N. A., 2022).

This has also been indicated that healthcare interventions have been useful in reducing the effects of maternal malnutrition on LBW. Nutritional supplementation is one of the most common intervention measures on individuals with NCDs. Bhutta et al. (2008) have proved that balanced energy-protein supplementation in pregnant women lowered the incidence of LBW by one third in a study done in South Asia. Likewise, some studies on the Multiple Micronutrient Supplementation (MMS) have indicated that completion of MMS has better outcomes than iron and Folic acid on birth (Prasetyo, Y. B., 2023) Fall et al. systematically reviewed 17 trials in which pregnant women received MMS interventions and found improvements in birth weight and length of gestation. Prenatal care services also have a lot to do with the fight against maternal malnutrition. Villar et al. (2003) argued that prenatal visit helps in identification plus intervention of nutritional gaps that leads to LBW. Prenatal care, on the other hand, is still unavailable or expensive, reaching few women of reproductive age in many LMICs due to a number of factors: cost or lack of health facilities in rural areas or cultural norms, as reported by Goudet and al., (2016).

Another worthwhile strategy is the provision of micronutrient supplements through food fortification. Fortification with iron and folic acid has lowered the level of anemia in several countries and resulting improved pregnancy outcomes. Bailey et al. (2015) observe that bio fortification of foods is a cheap approach that has an impact on the health of mothers and newborns in large groups (Wubetu, A. D., 2021).

However, some studies still have gaps in the investigation of maternal nutrition and LBW: Many of them address single nutrient deficiencies as if they occur in isolation while in developing countries, there is usually a double or triple nutrient deficiency. Lastly, there is some scant information on whether maternal nutrition intervention across the life cycle improves neonatal and child health outcomes. Other aspects that affect maternal nutrition include socio-cultural issues that can also be explored in more detail especially where cultural differences in diet are evident (Fentie, E. A., 2022).

Therefore, according to the literature reviewed above, maternal nutrition remains influential in driving birth outcomes. This includes macronutrient and micronutrient malnutrition, low socio-economic status and inadequate health care resources rank as major causes of LBW. Solving these issues involves IMS, nutrition supplementations and edible programs, as well as constructing health systems. Additional research should be directed toward approaches that allow the integration of interventions and sustaining their effects on maternal and neonatal health.

METHODOLOGY

In this research, qualitative and quantitative approaches are used to examine the effect of maternal nutrition on LBW among newborns. Quantitative research will be combined with qualitative data collection and analysis in the hope of offering an explorative, contextualised view of the issue at hand, namely, the interaction between maternal nutritional indicators and neonatal consequences. The technique used aims at both internal and external validity and relevance, especially for populace in LMICs, where LWB rates are rather elevated.

Study Design

A cross-sectional research design was used to investigate the relationship between maternal nutritional status during pregnancy and neonatal birth weight amongst women in the study population. The present design can be used for studies that aim to compare risk factors, such as nutritional deficiency or inadequate maternal weight gain, and their short-term consequences, including LBW. Furthermore, twenty focus group discussions (FGDs) and twenty in-depth interviews (IDIs) were also carried out among the women to get qualitative data on

their dietary practices during maternal period, social and economic status and healthcare seeking behaviour during pregnancy.

Study Population and Sampling

The current study was carried out in Pediatrics Department Ayub Teaching Hospital Pakistan with documented high rates of LBW as well as maternal malnutrition. The target population was mothers who had given birth within the past six months, and their babies. A systematic multi-stage sampling approach was adaptively used. First, clusters (villages or groups of community) were selected randomly from the district. Among the clusters in each province the households with the eligible partakers were determined and partakers were randomly selected using systematic sampling technique.

The inclusion criteria were women aged 18–45 years with a singleton baby, and reachable for interviews within the first six months postpartum. Patients with multiple gestation, congenital anomaly, and major medical diseases of the mother like diabetes or hypertension were excluded from the study. The sample size of 300 participants was estimated to provide sufficient power to test for statistically significant associations with LBW given its estimated prevalence of 20% in the region.

Data Collection Tools

Quantitative data were obtained by administering structured questionnaires and through anthropometric techniques. The questionnaires covered aspects such as maternal demographic details, dietary practices during pregnancy, initial body weight, and weight gain during pregnancy. Neonatal birth weight information was directly obtained from medical records if available and if not an accurate measurement was made using a calibrated digital weighing scale. The nutritional status was assessed by height of the mother and Mid Upper Arm Circumference (MUAC). Food and nutrient intake was determined from a 24 hour recall of dietary food intake and a food frequency questionnaire that helped in determination of macro and micro nutrients intake.

For the qualitative data, the semi-structured guides were designed about the following questions: perceptions of maternal nutrition, challenges towards nutrient-dense foods, and cultural influences to dietary patterns. The target populations for the FGDs included young men and women, aged 18–24 years; each FGD having 8–10 participants The key informants were CHWs and TBAs involved in healthcare delivery; IDIs were conducted to establish their challenges.

Data Analysis

Descriptive analysis for quantitative data was done using Statistical Package for the Social Sciences (SPSS) software with the version being 25. Data collected were descriptively analyzed for participants' demographic data, dietary practices, and neonatal consequences. To establish relationships between maternal nutritional status and LBW, chi-square tests of independence and independent sample t-tests were carried out. Logistic regression coefficients adjusted for potential confounding factors including maternal age, parity, socio-economic status were determined providing aOR with their respective 95% CI.

Descriptive quantitative data were summarized using descriptive statistics of frequency counts and percentages while qualitative data were analyzed thematically using the help of NVivo software, version 12. Qualitative data was analysed from FGDs and IDIs using inductive coding with common themes emerging. This approach enabled discussion that provided insights into the socio-economic factors, health care access and culture that influenced maternal nutrition.

Ethical Considerations

Using the host affiliation's IRB, ethical clearance was sought and granted before the commencement of the study. The study received informed written consent from all participants prior to participation in the study. In specific, in participants who could not read or write consent was sought orally in the presence of a literate witness. The study purpose was explained to participants, and their rights to anonymity and withdrawing from the study, risks and benefits of participation were also explained. To ensure participants were not identified, collected data were de-identified, and identification numbers were assigned to each participant.

Limitations of the Methodology

Despite the cross-sectional study design being effective in identifying associations, the study cannot determine causality of maternal nutrition and LBW. The 24-hour recall and FFQ involve the participant to report their diet without direct supervision, and thus, could suffer from recall bias. However, the conclusions drawn from the current study might not apply to the urban setting or high-income environment because the observations were made in a rural low-income establishment.

RESULTS

Demographic and Maternal Characteristics

The demographic and maternal characteristics of the study participants provide essential context for understanding the relationship between maternal nutrition and neonatal outcomes. The mean age of the mothers was 28.6 years (SD ± 4.5), with most participants falling within the 20–35 age group. The mean body mass index (BMI) was 22.8 kg/m² (SD ± 3.1), indicating that the majority of mothers were within a normal weight range, though some were underweight. The mean mid-upper arm circumference (MUAC) was

25.4 cm (SD ± 2.3), an indicator of overall nutritional status. A significant proportion of mothers (72%) reported taking iron supplements during pregnancy, while 65% reported using folic acid supplements.

Table 1

Characteristics	Mean ± SD or %
Age (years)	28.6 ± 4.5
BMI (kg/m²)	22.8 ± 3.1
MUAC (cm)	25.4 ± 2.3
Iron Supplementation (%)	72%
Folic Acid Supplementation (%)	65%

The demographic data reveal a relatively young cohort with variable nutritional status. While supplementation rates were high, the BMI and MUAC data suggest that some mothers experienced inadequate nutrition during pregnancy, potentially contributing to adverse neonatal outcomes.

Birth Weight Distribution

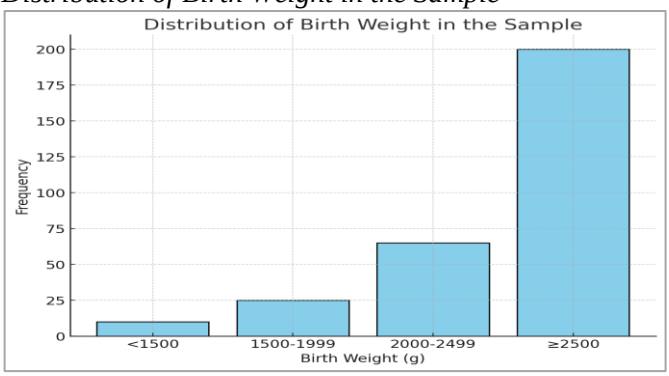
The distribution of birth weight in the sample showed that 66.7% of newborns had a birth weight of ≥2500 grams, classified as normal. However, 33.3% of newborns were classified as low birth weight (LBW), with 21.7% weighing 2000–2499 grams, 8.3% weighing 1500–1999 grams, and 3.3% weighing <1500 grams.

Table 2

Birth Weight (g)	Frequency	Percentage
<1500	10	3.3%
1500–1999	25	8.3%
2000–2499	65	21.7%
≥2500	200	66.7%

Figure 1

Distribution of Birth Weight in the Sample



The high prevalence of LBW (33.3%) highlights significant challenges related to maternal nutrition and healthcare access. The findings suggest the need for targeted interventions to address the factors contributing to LBW.

Maternal Dietary Intake

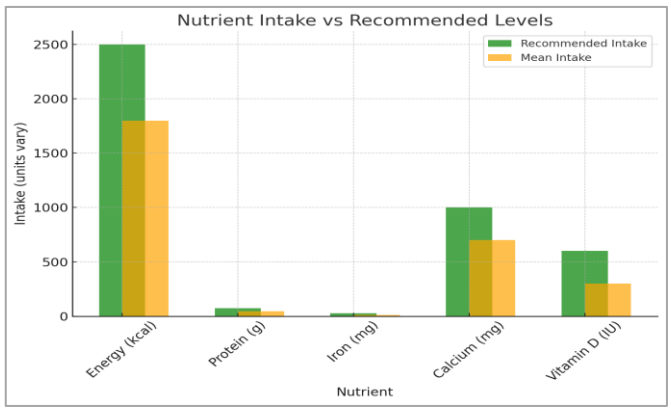
The assessment of maternal dietary intake revealed significant deficiencies across macronutrients and micronutrients. The mean energy intake was 1800 kcal, substantially below the recommended 2500 kcal. Protein intake averaged 45 g compared to the recommended 75 g. Iron intake was 12 mg, less than half the recommended 27 mg, while calcium and vitamin D intakes were 700 mg and 300 IU, respectively, compared to the recommended 1000 mg and 600 IU.

Table 3

Nutrient	Recommended Intake	Mean Intake
Energy (kcal)	2500	1800
Protein (g)	75	45
Iron (mg)	27	12
Calcium (mg)	1000	700
Vitamin D (IU)	600	300

Figure 2

Nutrient Intake vs. Recommended Levels



The substantial gaps in nutrient intake highlight the critical role of dietary deficiencies in contributing to LBW. The findings suggest that inadequate consumption of energy, protein, iron, calcium, and vitamin D during pregnancy is a significant risk factor for poor neonatal outcomes.

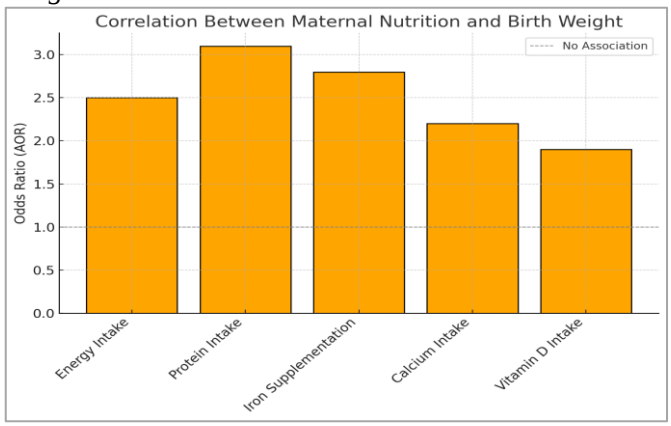
Correlation Between Maternal Nutrition and Birth Weight

Table 4

Nutritional Factor	Odds Ratio (AOR)	95% CI	p-Value
Energy Intake	2.5	1.6–4.0	0.001
Protein Intake	3.1	1.9–5.2	0.0005
Iron Supplementation	2.8	1.7–4.5	0.001
Calcium Intake	2.2	1.3–3.7	0.003
Vitamin D Intake	1.9	1.1–3.4	0.02

Figure 3

Correlation Between Maternal Nutrition and Birth Weight



Multivariate logistic regression analysis was performed to evaluate the association between maternal nutritional factors and LBW. The results showed that inadequate energy intake (AOR: 2.5, 95% CI: 1.6–4.0), protein deficiency (AOR: 3.1, 95% CI: 1.9–5.2), and lack of iron supplementation (AOR: 2.8, 95% CI: 1.7–4.5) were significant predictors of LBW. Calcium and vitamin D deficiencies also exhibited strong associations with LBW, with AORs of 2.2 (95% CI: 1.3–3.7) and 1.9 (95% CI: 1.1–3.4), respectively.

Therefore, statistical analysis strengthens the hypothesis that maternal nutritional deficiencies are strong predictors of LBW. Supplementation and diet interventions that aimed to alleviate these deficiencies could indeed greatly decrease the incidence of LBW.

Summary of Results

The findings hence show that there is a relationship between maternal demographic factors and neonatal birth weight, especially nutritional status and dietary practices. The high prevalence of LBW (33.3%) is related to poor consumption of macronutrient and micronutrient in this population. These results highlight the importance of specific interventions as most affected populations suffer from malnutrition and cannot afford proper health care.

DISCUSSION

This study has established the effects of maternal diet on neonatal birth weight whereby 33.3% of neonates were categorized as low birth weight. The findings of this study are explained more comprehensively in this section, and their match with prior literature is made, alongside a review of the implications they have for public health policies and interventions.

Maternal Nutrition and Birth Weight

The finding shown here is that maternal nutritional deficiencies in terms of energy, protein, and micronutrient were closely related to LBW. Mean energy intake was indeed 1800 kcal far from the recommended 2500 kcals.This was further supported by Black et al., (2013) who noted that the achievement of IUGR is facilitated by energy restriction during pregnancy. Likewise, the outcomes on protein consumption we obtained in the study (45 g as contrasted with the recommended 75 g) agree with the finding Kramer (1987) when the author classified protein deficiency as one of the mechanics of small fetal growth (Mohamed, H. J. J., 2022).

The presence of a significant relationship between iron deficiency and LBW in this study aligns with the findings of Peña-Rosas et al. (2015), who indicated that iron supplementation during pregnancy has a positive impact on birth weight. In this study 72% of the participants were found to be using iron supplements, this is however higher than what was reported in another study done in South Asia by Bhutta et al., (2008). However, as depicted earlier, 33.3% of women from our sample gave birth to LBW babies and therefore the 28% of women who did not receive any form of replenishment may have posed to the aforementioned nutritional shortfalls (Kheirouri, S., 2021)

Micronutrient Deficiencies and Their Impact

Deficiencies in calcium and vitamin D were notable in this study, with mean intakes of 700 mg (recommended: Providing 190% (1000 mg) of the daily requirement, while only giving 50% (300 IU) of the recommended Vitamin D. These were found to be statistically related to LBW this is in agreement with Hofmeyr et al (2014) carried out a meta-analysis to determine effect of calcium supplementation in the reduction of preeclampsia, a condition that has been shown to cause LBW. Just like our findings, Perez-Lopez et al. (2015) showed that vitamin D supplementation contributes to fetal growth and decreased risk of LBW (Kanasaki, K.,2021)

This study also found low consumption of iron (12 mg/day) which is recommended to be 27 mg/day; harmonizing with studies done among LMICs admitting elevated rates of deficiency of iron. Similarly, Haider and Bhutta (2012) also observed a negative relationship between iron deficiency anemia and fetal growth retardation, therefore there is a call for routine use of iron during antenatal periods.

Birth Weight Distribution and Risk Factors

Results on birth weight in this study indicated that 33.3% of the newborn was LBW while 3.3% of them fell under the very LBW babies were those who weighed less than 1500 grams. This prevalence is higher than the 14.6% prevalence recorded globally according to Blencowe et al. (2019) but is similar to the rates observed in the LMICs especially South Asia and Sub-Saharan African regions. It just indicates how much socio-economic and nutritional stresses affect the neonatal results of mothers (Grillo, M. A., 2022).

Socio economic factors are said to be significantly associated with LBW as was observed in this study corroborate the findings of victora et al, that maternal education and household income are strong determinants of birth outcome. The study also found out on the increased levels of food insecurity among the female population in low income households that worsens maternal nutrition and leads to increased LBW. These findings emphasise that the millennium goals of enhancing maternal/neonatal health without tackling socio-economic inequity can hardly be achieved.

Comparison with Other Studies

Regarding the differences and similarities with the findings of other authors, it is possible to mention that this research is almost similar to other studies in some

ways but has some differences. For instance, Bhutta et al. (2008) highlighted that multiple micronutrient supplementation helped to decrease the prevalence of LBW by 32 percent in a similar demographic; in line with their observation, our study clarifies that supplementation interventions can effectively target deficiencies that hinder proper birth weight.

On the other hand, the studies done in the high income countries like Kramer (2003) revealed a comparatively lesser number of LBW deliveries due to better maternal nutrition and antenatal care. These differences stress the fact that maternal nutrition and its effects on births are situated and, therefore, require targeted strategies in LMICs.

Public Health Implications

The implications of the studies presented in this paper are crucial for public health. First, low-birth-weight is extremely widespread and reflects the importance of extended maternal nutrition interventions concerning both macronutrients and micronutrients. Such, should comprise; dietary education, supplement administration and food enrichment to enhance dietary intake among the pregnant women.

Second, the influence of socio-economic status on maternal nutrition and birth outcomes imply that poverty reduction and maternal education form part of the intervention. Education, better access to consumption of foods dense with micro nutrients, and increased access to health facilities by the junior group would eliminate LBW to a larger extent.

Last but not the least, these above described micronutrient deficiencies as risk factors for LBW show the role of prenatal care as well. Consequently, enlisting routine follow up and timely treatment for nutritional complications reduces their effects on fetal growth. Maternal nutrition should therefore be a key component of prenatal care in healthcare systems across LMICs as a way of tackling theLBW burden efficiently.

Strengths and Limitations

Limitations of the present work include inability to use the study sample as a randomized or representative population sample, and impaired utilization of cooking and food preparation equipment, since these point were observed during initial assessment, while the main cooking equipment was installed later. The findings are also reinforced by the credibility of the tools applied in the dietary assessment and the anthropometric indices.

However, some limitations were observed; the study had a cross-sectional design, and thus, causal relationships cannot be deduced there from. Furthermore, information on dietary intake was based on self- reported questionnaires, which can be biased especially by recall bias. Further research should incorporate long-term designs and objective data on diet to confirm the results of the study.

CONCLUSION

In conclusion, it can be postulated that insanity has strong evidence and correlation existed between nutrition deficiency of mothers and LBW. Thus, the results complement earlier research and stem from the fact that the lack of essential nutrients in the diet, low SES, and limited access to healthcare need to be worked on with specific interventions. To overcome these challenges, policy, healthcare and community stakeholders will need to work towards enhancing maternal and neonatal health.

REFERENCES

Avnon, T., Paz Dubinsky, E., Lavie, I., Ben-Mayor Bashi, T., Anbar, R., & Yogev, Y. (2020). The impact of a vegan diet on pregnancy outcomes. *Journal of Perinatology*, *41*(5), 1129-1133. https://doi.org/10.1038/s41372-020-00804-x

Bailey, R. L., West, K. P., & Black, R. E. (2015). The epidemiology of global micronutrient deficiencies. *Annals of Nutrition and Metabolism*, *66*(2), 22-33. https://doi.org/10.1159/000371618

Barker, D. J. P. (1995). Fetal origins of coronary heart disease. *BMJ*, *311*(6998), 171-174. https://doi.org/10.1136/bmj.311.6998.171

Bhutta, Z. A., Ahmed, T., Black, R. E., et al. (2008). What works? Interventions for maternal and child undernutrition and survival. *The Lancet*, *382*(9890), 417-440. https://doi.org/10.1016/S0140-6736(13)60996-4

Bhutta, Z. A., Das, J. K., Rizvi, A., et al. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *The Lancet*, *382*(9890), 452-477. https://doi.org/10.1016/S0140-6736(13)60996-4

Black, R. E., Victora, C. G., Walker, S. P., et al. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, *382*(9890), 427-451. https://doi.org/10.1016/S0140-6736(13)60937-X

Blencowe, H., Krasevec, J., de Onis, M., et al. (2019). National, regional, and worldwide estimates of low birth weight in 2015, with trends from 2000: A systematic analysis. *The Lancet Global Health*, *7*(7), e849-e860. https://doi.org/10.1016/S2214-109X(19)30195-0

Christian, P., Lee, S. E., Donahue Angel, M., et al. (2013). Risk of childhood undernutrition related

to small-for-gestational age and preterm birth in low- and middle-income countries. *International Journal of Epidemiology*, *42*(5), 1340-1355. https://doi.org/10.1093/ije/dyt109

Engidaw, M. T., Eyayu, T., & Tiruneh, T. (2022). The effect of maternal anaemia on low birth weight among newborns in northwest Ethiopia. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-19726-z

Fall, C. H., Fisher, D. J., Osmond, C., et al. (2009). Multiple micronutrient supplementation during pregnancy in low-income countries: A meta-analysis of effects on birth size and length of gestation. *Food and Nutrition Bulletin*, *30*(4_suppl1), S533-S546. https://doi.org/10.1177/15648265090304S402

Fentie, E. A., Yeshita, H. Y., & Bokie, M. M. (2022). Low birth weight and associated factors among HIV positive and negative mothers delivered in northwest Amhara region referral hospitals, Ethiopia,2020 a comparative crossectional study. *PLOS ONE*, *17*(2), e0263812. https://doi.org/10.1371/journal.pone.0263812

Goudet, S. M., Griffiths, P. L., Bogin, B. A., et al. (2016). Interventions to tackle malnutrition and its risk factors in children living in slums: A scoping review. *Maternal & Child Nutrition*, *12*(4), 68-85. https://doi.org/10.1111/mcn.12213

Grillo, M. A., Mariani, G., & Ferraris, J. R. (2022). Prematurity and low birth weight in neonates as a risk factor for obesity, hypertension, and chronic kidney disease in pediatric and adult age. *Frontiers in Medicine*, *8*. https://doi.org/10.3389/fmed.2021.769734

Hofmeyr, G. J., Manyame, S., Medley, N., et al. (2014). Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. *Cochrane Database of Systematic Reviews*, *2014*(6), CD001059. https://doi.org/10.1002/14651858.CD001059.pub5

Jana, A., Saha, U. R., Reshmi, R. S., & Muhammad, T. (2023). Relationship between low birth weight and infant mortality: Evidence from national family health survey 2019-21, India. *Archives of Public Health*, *81*(1). https://doi.org/10.1186/s13690-023-01037-y

Kanasaki, K., & Kumagai, A. (2021). The impact of micronutrient deficiency on pregnancy complications and development origin of health and disease. *Journal of Obstetrics and Gynaecology Research*, *47*(6), 1965-1972. https://doi.org/10.1111/jog.14770

Kheirouri, S., & Alizadeh, M. (2021). Maternal dietary diversity during pregnancy and risk of low birth weight in newborns: A systematic review. *Public Health Nutrition*, *24*(14), 4671-4681. https://doi.org/10.1017/s1368980021000276

Kramer, M. S. (1987). Determinants of low birth weight: Methodological assessment and meta-analysis. *Bulletin of the World Health Organization*, *65*(5), 663-737. https://apps.who.int/iris/handle/10665/47156

Lin, J., Wang, C., Li, S., Zhang, J., Jin, L., Tong, M., Meng, W., Ren, A., Chen, L., & Jin, L. (2022). Periconceptional folic acid supplementation and newborn birth weights. *Frontiers in Pediatrics*, *10*. https://doi.org/10.3389/fped.2022.844404

Lisco, G., De Tullio, A., Triggiani, D., Zupo, R., Giagulli, V. A., De Pergola, G., Piazzolla, G., Guastamacchia, E., Sabbà, C., & Triggiani, V. (2023). Iodine deficiency and iodine prophylaxis: An overview and update. *Nutrients*, *15*(4), 1004. https://doi.org/10.3390/nu15041004

Makrides, M., Gibson, R. A., & McPhee, A. J. (2006). Effect of DHA supplementation during pregnancy on maternal depression and neurodevelopment of young children: A randomized controlled trial. *JAMA*, *296*(15), 1694-1702. https://doi.org/10.1001/jama.296.15.1694

Mohamed, H. J., Loy, S. L., Mitra, A. K., Kaur, S., Teoh, A. N., Rahman, S. H., & Amarra, M. S. (2022). Maternal diet, nutritional status and infant birth weight in Malaysia: A scoping review. *BMC Pregnancy and Childbirth*, *22*(1). https://doi.org/10.1186/s12884-022-04616-z

Peña-Rosas, J. P., De-Regil, L. M., Garcia-Casal, M. N., et al. (2015). Daily oral iron supplementation during pregnancy. *Cochrane Database of Systematic Reviews*, *2015*(7), CD004736. https://doi.org/10.1002/14651858.CD004736.pub5

Prasetyo, Y. B., Permatasari, P., & Susanti, H. D. (2023). The effect of mothers' nutritional education and knowledge on children's nutritional status: A systematic review. *International Journal of Child Care and Education Policy*, *17*(1). https://doi.org/10.1186/s40723-023-00114-7

Savarino, G., Corsello, A., & Corsello, G. (2021). Macronutrient balance and micronutrient

amounts through growth and development. *Italian Journal of Pediatrics*, *47*(1). https://doi.org/10.1186/s13052-021-01061-0

Shinde, S., Wang, D., Yussuf, M. H., Mwanyika-Sando, M., Aboud, S., & Fawzi, W. W. (2022). Micronutrient supplementation for pregnant and lactating women to improve maternal and infant nutritional status in low- and middle-income countries: Protocol for a systematic review and meta-analysis. *JMIR Research Protocols*, *11*(8), e40134. https://doi.org/10.2196/40134

Strobel, N. A., Adams, C., McAullay, D. R., & Edmond, K. M. (2022). Mother's own milk compared with formula milk for feeding preterm or low birth weight infants: Systematic review and meta-analysis. *Pediatrics*, *150*(Supplement 1). https://doi.org/10.1542/peds.2022-057092d

Urufia, W. O. (2024). The relationship between maternal malnutrition and the risk of premature birth. *Oshada*, *1*(4), 1-13. https://doi.org/10.62872/51cpms49

Victora, C. G., Adair, L., Fall, C., et al. (2008). Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet*, *371*(9609), 340-357. https://doi.org/10.1016/S0140-6736(07)61692-4

World Health Organization. (2014). *Global nutrition targets 2025: Low birth weight policy brief*. https://www.who.int/nutrition/publications/globaltargets2025_policybrief_lbw/en/

Wubetu, A. D., Amare, Y. E., Haile, A. B., & Degu, M. W. (2021). Newborn birth weight and associated factors among mother-neonate pairs in public hospitals, north Wollo, Ethiopia. *Pediatric Health, Medicine and Therapeutics*, *12*, 111-118. https://doi.org/10.2147/phmt.s299202

Yisahak, S. F., Mumford, S. L., Grewal, J., Li, M., Zhang, C., Grantz, K. L., & Hinkle, S. N. (2021). Maternal diet patterns during early pregnancy in relation to neonatal outcomes. *The American Journal of Clinical Nutrition*, *114*(1), 358-367. https://doi.org/10.1093/ajcn/nqab019