

ASSOCIATION OF MATERNAL DIETARY INTAKE WITH INFANT NUTRITION STATUS: A CROSS-SECTIONAL STUDY

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Abstract

This cross-sectional study investigated the association between maternal dietary intake and infant nutrition status in District Mardan, Pakistan, a region facing significant maternal and child undernutrition. A quantitative, community-based study was conducted with 46 mothers of infants aged 3-11 months. Data on socio-demographics, maternal diet (via 24-hour recalls and a global dietary diversity questionnaire), and infant nutritional status (Weight-for-Length) were collected. The diverse maternal demographic profile included varied age groups (34.78% <20 years, 32.61% 21-30 and 30-40 years), anthropometric measurements (47.83% height <160 cm; 43.48% weight 55-65 kg; 43.48% normal BMI, 30.43% overweight/obese, 26.09% underweight), and socioeconomic statuses (39.13% lower). Maternal diets favored staples but lacked frequent intake of fruits, dairy, and animal proteins. While breastfeeding was common (54.35%) and supplementary feeding frequent (65.21% 3-6 times/day), a significant proportion of infants, both male (28.57%) and female (22.22%), were in the "-1 SD" weight category, with many in lower weight categories (-2 SD: male 21.43%, female 27.78%). No infants were overweight. These findings highlight the critical link between maternal health, feeding practices, and infant well-being, emphasizing the need for targeted interventions.

INTRODUCTION

Proper nutrition plays a foundational role in ensuring optimal health, enabling individuals, especially children to grow, develop, work, and resist infections effectively (YalewdegBirhane and Adissu, 2020). The early years of life are critical, as a child's physical, mental, and social development are strongly influenced by the quality of nutrition received from birth (Imtiaz et al., 2025; Iruka, 2025). Malnutrition remains a major global concern, contributing to

nearly half of the 10.4 million child deaths annually in developing nations (Ali et al., 2021). In 2012, global estimates reported 8% prevalence of wasting and 3% of severe wasting among children (Quansah and Boateng, 2020). The right to adequate nutrition is recognized internationally through declarations such as the Convention on the Rights of the Child, which stresses the importance of early childhood development and maternal well-being (Anato et al.,

2020); (Belete et al., 2022). However, many mothers and infants around the world continue to face barriers in accessing sufficient nutrition, accurate information, and safe living conditions (Jamshed et al., 2020; Burki, 2025; Mughis et al., 2025).

Malnutrition, defined by the World Health Organization as an imbalance in energy and nutrient intake, has far-reaching impacts on both individuals and society (Singh, 2025). It is measured using Z-scores, where a score below -2 SD indicates undernutrition and above +2 SD signifies overweight status in children. Poor nutrition compromises immunity, increases susceptibility to infections, and hampers progress toward societal development goals (Charnley et al., 2021). Moreover, maternal nutrition directly influences pregnancy outcomes, birth weight, and the future health and academic success of children (Gelebo et al., 2021; Rahmannia et al., 2025).

In Pakistan, maternal and child undernutrition are pressing public health issues. The National Survey of Pakistan (2022) revealed that 44% of children suffer from stunted growth and 20% of mothers from anemia, often due to iron deficiency (Ahmad et al., 2022). Micronutrient deficiencies, especially in low-income settings, can cause severe consequences such as cognitive deficits, anemia, and poor fetal development (Marshall et al., 2022). Advancements in science and biotechnology such as supplementation and bio-fortification of crops, offers promising solutions to address these deficiencies (OhKeats and Bhutta, 2020).

Maternal undernutrition is also associated with adverse pregnancy outcomes, including low birth weight and preterm births (Asferie et al., 2025), (Khaliq et al., 2022). These complications are often triggered by stress-related hormonal pathways that lead to premature uterine contractions (SaakaMutaru and Osman, 2021). Nutritional interventions, particularly those rich in antioxidants and omega-3 fatty acids, can mitigate these risks (Ribas et al., 2021).

The intricate relationship between maternal dietary intake and infant nutrition status is a critical determinant of health outcomes for both mother and child (FikaduTamiru and Ademe, 2025), (Nickel et al., 2025). This cross-sectional study aims to explore this association, considering the profound influence of maternal nutrition during pregnancy and lactation on

infant well-being. In response, the Pakistani government, in collaboration with organizations like UNESCO and the UN, has initiated programs aimed at reducing malnutrition, especially in regions like Khyber Pakhtunkhwa. Despite these efforts, there remains a critical need to understand the relationship between maternal dietary intake and infant nutritional outcomes in specific local contexts. This study aims to analyze the association of maternal dietary intake with infant nutrition status in Mardan, contributing to the evidence base study necessary for designing effective interventions.

MATERIALS AND METHODS

A quantitative research type and a community based cross-sectional descriptive study was adopted in the current study. Mothers from District Mardan having infants ages 3 to 11 months were chosen as the study population and data was collected from them about their dietary intake and their child nutrition status. The sample was chosen through convenient sampling technique. While a prevalence of 30 percent of malnourished was taken from the study of (Zaman, Abid & Bilal, 2021). Thus, based on the convenient sampling technique a sample of 46 mothers was determined. The data was collected through close ended questionnaire about socio-demographics characteristics, maternal dietary intake and nutrition status of infants. Maternal dietary intake was measured through global dietary diversity questionnaire. The information was collected from the 24-hour recalls, to assess dietary diversity score of each study subject. Mothers were also asked about nutritional status of the infants from 3 to 11 months. The data was analyzed through different statistical techniques for assessment of association between dietary intake of mother and nutritional status of their infants. Frequency distribution and descriptive analysis was conducted in the current study through SPSS.

RESULTS AND DISCUSSION

This cross-sectional study investigated the association of maternal dietary intake with infant nutrition status, considering various socioeconomic and demographic factors that significantly influence maternal nutrition, including income, age, education, cultural beliefs, and geographic location (Ali et al., 2021). The

demographic profile of the mothers in the sample revealed varied distributions across several key characteristics. In terms of age, approximately 34.78% of mothers were below 20 years, while 32.61% fell into the 21-30 age group. A similar proportion, 32.61%, belonged to the 30-40 age group. Regarding anthropometric measurements, the majority of mothers (47.83%) had a height below 160 cm, with 36.96% in the 160-170 cm range, and 15.22% above 170 cm. For weight, 43.48% of mothers were between 55 and 65 kg, 39.13% weighed below 55 kg, and 17.39% were above 65 kg. The Body Mass Index (BMI) distribution showed that 43.48% of mothers were in the normal weight range (18.5-24.9). However, a notable proportion of mothers were outside this range, with 30.43% categorized as overweight or obese (BMI above 24.9) and 26.09% as underweight (BMI below 18.5). This highlights a considerable variability in the BMI status within the sample.

Socioeconomic factors also played a significant role. The lack of maternal education, inadequate access to water and sanitation services, and lower socioeconomic status are key factors contributing to inequality of opportunity in stunting among children under five in Pakistan (Sriram and Naz, 2025). The majority of mothers (39.13%) belonged to the lower socio-economic status, followed by 32.61% in the middle socio-economic status, and 28.26% in the upper socio-economic status. Family structure was also diverse, with 47.83% of mothers from nuclear families and 52.17% from joint families. These socioeconomic and demographic factors are crucial in understanding maternal nutrition. Food accessibility, mental health, and social support are known to further shape dietary choices during pregnancy (Anato et al., 2020). Furthermore, pre-existing health conditions and pregnancy-related discomforts can impact appetite and nutrient intake (Charnley et al., 2021). The observed distributions in our sample underscore the complex interplay of these factors influencing maternal nutritional status, which in turn has implications for infant outcomes.

Maternal undernutrition, particularly prevalent in low-resource settings, is a significant concern due to its association with adverse infant outcomes such as intrauterine growth restriction, low birth weight, and increased neonatal mortality. Chronic maternal

undernutrition and stunting further elevate delivery risks and long-term child health complications (Pearce and Langley-Evans, 2022). While the extent to which maternal diet directly affects breast milk composition is a subject of ongoing debate, these concerns are amplified in low-resource socioeconomic settings where food insecurity is prevalent (Permatasari and Chadirin, 2022). The notable proportion of mothers in our sample from lower socioeconomic strata and those categorized as underweight or overweight/obese highlight the potential vulnerability of this population to suboptimal maternal and, consequently, infant nutritional status. Future analysis will delve into the specific associations between dietary intake patterns and infant nutritional outcomes within these diverse maternal profiles.

Maternal Dietary Intake

A mother's dietary intake plays a pivotal role in shaping both pregnancy outcomes and the nutritional status of her infant. As highlighted by (Adhikari et al., 2022) a well-rounded maternal diet characterized by its quality, quantity, and diversity is crucial for reducing the risk of gestational diabetes, preterm birth, and low birth weight. This is achieved by providing essential nutrients such as folate, iron, calcium, and omega-3 fatty acids. A study by Ribas further emphasizes that the quality and quantity of nutrients received by newborns are primarily dependent on maternal dietary intake and breast milk (Ribas et al., 2021). Essential micronutrients like iron, calcium, zinc, and vitamins A, C, and D are vital for healthy infant development, supporting functions such as hemoglobin formation, bone growth, immune development, and cognitive health (YalewdegBirhane and Adissu, 2020). For instance, zinc is known to contribute to bone metabolism, enzymatic activity, and sensory function, while vitamin A supports vision and epithelial health (Quansah and Boateng, 2020). The dietary intake patterns observed among the mothers in this cross-sectional study reflect a blend of traditional habits, cultural influences, and individual preferences, which directly influence the nutritional landscape for their infants. The majority of respondents, specifically 35, 30, and 32 mothers, reported daily consumption of rice, pulses, and vegetables, respectively. This aligns with traditional dietary patterns in many cultures where these staples

form the foundation of daily meals, providing a consistent source of macronutrients.

While fruits are recognized for their nutritional value and importance in a balanced diet due to their rich vitamin and mineral content, their consumption frequency varied among the mothers. Most mothers reported consuming fruits on a weekly (15 respondents) or monthly (10 respondents) basis, with a smaller proportion (10 respondents) indicating daily consumption. This suggests that despite their acknowledged importance, fruits may not be consumed as frequently as staple foods, potentially leading to varied micronutrient intake from this food group for both mother and infant as shown in Figure 1.

Milk, a crucial source of calcium for bone health, also showed diverse consumption patterns. While some mothers reported weekly (20 respondents) or monthly (7 respondents) intake, others (15 respondents) consumed milk daily. This variability in milk consumption could be attributed to factors such as cultural preferences or access to dairy products, impacting the availability of essential calcium for both maternal and infant bone development. Similarly, the consumption of curd and butter, common dairy products providing additional nutrients and flavor varied. While (12 women) reported daily consumption, others consumed them less frequently, with (10 individuals) on a weekly basis and (8 women) on a monthly basis.

Consumption of fish and meat products, which are vital sources of protein, iron, and omega-3 fatty acids (Badoni et al., 2021), was reported less frequently in present study. Mothers consumed these items occasionally (10 and 8 respondents for fish and meat respectively) or monthly (15 and 10 respondents for fish and meat respectively). This limited intake of fish and meat products may suggest constraints such as high prices, indicating limited access or availability within the community. Such infrequent consumption could have implications for the intake of crucial micronutrients like iron and B vitamins, potentially affecting hemoglobin formation and overall infant development (Chouli et al., 2025). Overall, these observed dietary intake patterns among mothers directly correlate with the availability of essential nutrients, influencing the overall well-being and nutritional status of their infants. This study

investigated the association between maternal dietary intake and infant nutrition status within a sample population. The findings underscore the critical link between maternal health, feeding practices, and the nutritional well-being of infants in their early years also reported by (Marshall et al., 2022).

Infant Feeding Practices

Optimal infant nutrition is significantly influenced by maternal feeding practices (Ali et al., 2025). In the current study, a majority of mothers (54.35%) breastfed their infants, which is recognized as the optimal source of nutrition, providing a unique blend of essential nutrients and immune-boosting components (Paul and Saha, 2022). Furthermore, a substantial proportion of mothers (45.65%) ensured their infants received adequate sustenance by feeding them more than three times a day, irrespective of the duration. This aligns with findings from similar studies, which reported that dietary interventions, particularly micronutrient supplementation, can significantly enhance linear growth among infants and young children (IYC) (Anato et al., 2020).

Complementary feeding, introduced appropriately around six months, is crucial for sustained growth; however, inadequate timing or quality can lead to malnutrition (Protas and Mweya, 2021). In this study, a large majority (91.3%) of mothers had already initiated supplementation for their children. Notably, 65.21% of mothers provided supplementary meals three to six times a day, aiming to ensure their children received essential nutrients and to facilitate proper growth and development as shown in table 2. This highlights the importance of encouraging and supporting optimal feeding habits to ensure the long-term health and well-being of infants (Ajmal, 2024). However, the presence of some mothers who had not yet begun giving their children a supplement may indicate a potential for delayed nutrient intake (Sriram and Naz, 2025).

Nutrition Status of Infants

Regular growth monitoring and responsive feeding practices are essential for the timely identification and management of any developmental deviations (Rahfiludin and Pangestuti, 2020). The nutritional status of infants in the sample was assessed using the Weight-for-Length Reference Card, plotting weight

and length against standard deviations from the median.

For male infants, the majority (28.57%) fell into the "-1 SD" weight category, with weights ranging from 6.2 kg to 6.8 kg and lengths from 66 cm to 71 cm. This was followed by the "-2 SD" range, encompassing 21.43% of the sample, with weights between 6.0 kg and 6.5 kg and lengths between 65 cm to 70 cm. The least common categories were "+2 SD" and "+3 SD," each comprising only 3.57% of the sample, with weights ranging from 6.8 kg to 7.5 kg and 7.1 kg to 7.9 kg, respectively, and corresponding lengths as shown in table 3.

Similarly, among female infants, the "-1 SD" category was the most prevalent, representing 22.22% of the sample, with weights ranging from 6.0 kg to 6.6 kg and lengths from 64 cm to 69 cm. The "-2 SD" category

followed closely, including 27.78% of the sample, with weights between 5.8 kg to 6.3 kg and lengths between 63 cm to 68 cm. Significantly, no female infants fell into the "+3 SD" and "+4 SD" categories, indicating an absence of exceptionally high-weight or long-length infants in this sample as shown in table 4. In both boys and girls, a substantial proportion of infants were within the normal range, indicated by the "-1 SD" and "Normal" categories. However, variations were observed, with some infants classified as malnourished or at risk of malnutrition, particularly in the lower weight categories. Notably, no infants in the sample were classified as overweight. This analysis underscores the critical need for continuous monitoring of infants' growth and nutritional status to identify those who may require additional support or intervention for optimal health and development.

Table 1: Socio-Demographics of mothers

Variable	Categories	Frequency	Percent (%)
Age Group	Below 20 years	16	34.78
	21-30 years	15	32.61
	30-40 years	15	32.61
Height (cm)	Below 160	22	47.83
	160-170	17	36.96
	Above 170	7	15.22
Weight (kg)	Below 55	18	39.13
	55-65	20	43.48
	Above 65	8	17.39
BMI Category	Below 18.5	12	26.09
	18.5-24.9	20	43.48
	Above 24.9	14	30.43
Socio-economic Status	Lower	18	39.13
	Middle	15	32.61
	Upper	13	28.26
Type of Family	Nuclear	22	47.83
	Joint	24	52.17

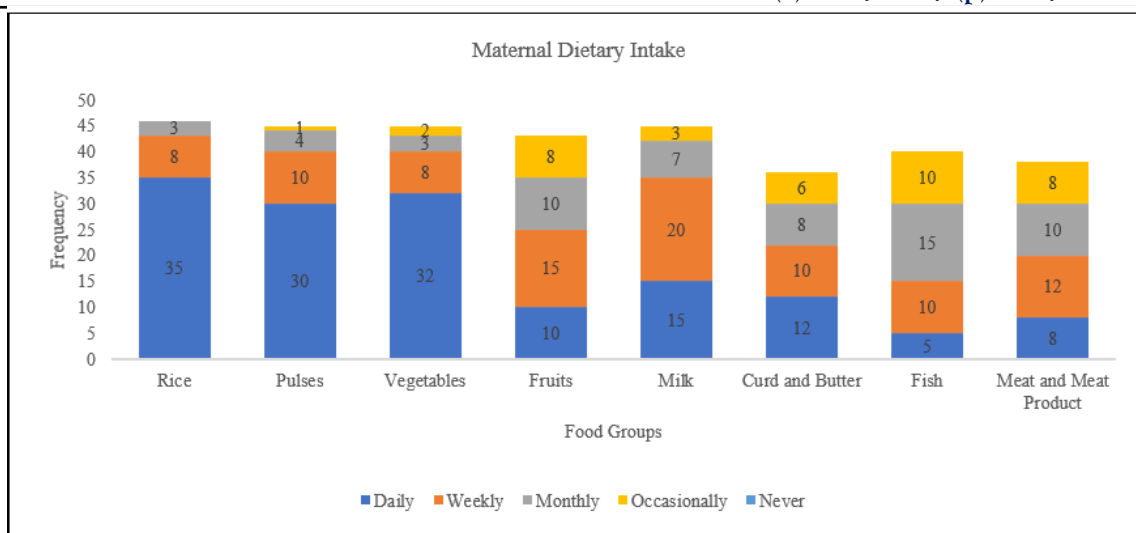
**Figure 1. Maternal Dietary Intake**

Table 2: Infant Feeding Practices		
Feeding Practice	Frequency	Percent
How do you feed your child?		
- Breastfeeding	25	54.35%
- Bottle feeding	21	45.65%
How many times do you feed your child in daytime?		
- Less than 3 times	5	10.86%
- 3 to 6 times	21	45.65%
- More than 6 times	20	43.47%
How many times do you feed your child in nighttime?		
- Less than 3 times	10	21.73%
- 3 to 6 times	28	60.86%
- More than 6 times	8	17.39%
Have you started giving complementary foods to your child?		
- Yes	42	91.3%
- No	4	8.7%
How many times do you feed complementary foods to your child in 24 hours?		
- Less than 3 times	8	17.39%
- 3 to 6 times	30	65.21%
- More than 6 times	8	17.39%

Table 3. Nutrition Status of Infants (Boys)					
Weight-for-Length Status	Weight Category (kg)	Length Category (cm)	Frequency	Percent	Nutritional Status
-4 SD	5.3 - 5.7	62 - 67	2	7.14%	Malnourished
-3 SD	5.7 - 6.2	64 - 69	4	14.29%	Malnourished
-2 SD	6.0 - 6.5	65 - 70	6	21.43%	At Risk of Malnutrition
-1 SD	6.2 - 6.8	66 - 71	8	28.57%	Normal
Median	6.4	67	2	7.14%	Normal
+1 SD	6.5 - 7.2	68 - 73	4	14.29%	Normal
+2 SD	6.8 - 7.5	69 - 74	1	3.57%	Normal
+3 SD	7.1 - 7.9	70 - 75	1	3.57%	Overweight
+4 SD	7.3 - 8.0	71 - 76	0	0.00%	Overweight

Table 4. Nutrition Status of Infants (Girls)					
Weight-for-Length Status	Weight Category (kg)	Length Category (cm)	Frequency	Percent	Nutritional Status
-4 SD	5.1 - 5.5	60 - 65	1	5.56%	Malnourished
-3 SD	5.5 - 6.0	62 - 67	3	16.67%	Malnourished
-2 SD	5.8 - 6.3	63 - 68	5	27.78%	At Risk of Malnutrition
-1 SD	6.0 - 6.6	64 - 69	4	22.22%	Normal
Median	6.1	65	2	11.11%	Normal
+1 SD	6.3 - 6.9	66 - 71	2	11.11%	Normal
+2 SD	6.6 - 7.1	67 - 72	1	5.56%	Normal

Conclusion

This cross-sectional study established a clear association between maternal dietary intake and infant nutrition status, highlighting the profound influence of maternal health and feeding practices on infant well-being. The demographic profile of mothers revealed a diverse population with varying ages, anthropometric measurements, and socioeconomic backgrounds, all of which are critical determinants of maternal nutrition. The observed dietary patterns, characterized by frequent consumption of staples but less frequent intake of fruits, dairy, and animal proteins, directly correlate with the availability of essential nutrients for both mothers and infants. Despite a high prevalence of breastfeeding (54.35%) and frequent supplementary feeding (65.21% three to six times a day), the nutritional status of infants

showed a significant proportion falling into lower weight-for-length categories (-1 SD and -2 SD), indicating a potential risk of malnutrition. The absence of overweight infants further emphasizes this concern. The findings underscore the complex interplay of socioeconomic factors, maternal dietary choices, and feeding practices in shaping infant nutritional outcomes. Particularly, the notable proportion of mothers from lower socioeconomic strata and those categorized as underweight or overweight/obese point to potential vulnerabilities within this population that can impact infant nutritional status.

Recommendation

Based on the findings of this study, it is recommended that targeted nutritional interventions be

implemented to improve maternal dietary intake, especially for mothers in lower socioeconomic strata and those identified as underweight or overweight/obese. These interventions should focus on promoting diversified diets rich in micronutrients, emphasizing the increased consumption of fruits, dairy products, fish, and meat, while considering affordability and accessibility. Furthermore, educational programs should be developed to reinforce the importance of optimal infant feeding practices, including continued support for breastfeeding and timely, appropriate introduction of complementary foods. Special attention should be given to ensuring that all infants receive necessary supplements to meet their nutritional requirements. Regular growth monitoring and responsive feeding practices are essential for early identification and management of any developmental deviations. Future research should delve deeper into the specific associations between maternal dietary intake patterns and infant nutritional outcomes across diverse maternal profiles to inform more precise and effective public health strategies.

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