Original Research Article

PREVALENCE AND DETERMINANTS OF PROTEIN-ENERGY MALNUTRITION (PEM) AMONG CHILDREN UNDER 5 YEARS OF AGE IN A RURAL COMMUNITY OF LAHORE

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Abstract: *Malnutrition refers to an inadequate supply of nutrients and energy to the body cells, compared to the body's requirements for maintaining growth and ensuring daily functions. It is a major health burden in developing countries and can be categorized as under-nutrition and over-nutrition. This study aimed to determine the prevalence and determinants of Protein Energy Malnutrition (PEM) among children under 5 years of age in a rural community of Lahore. A quantitative descriptive cross-sectional study was conducted in the Lakhodair community of Lahore. A sample of 150 married females participated in the study, and a purposive sampling was used to collect data. The results revealed that 43% of the participants were male mothers, and 57% were female. PEM was categorized as mild, moderate, and severe. Severe PEM was noted in children under the age of 5 years in this Lakhodair community, with an incidence rate of 4.22%. It was concluded that the prevalence rate of PEM among children under 5 years of age in a rural community of Lahore was 4.22%. Protein Energy Malnutrition (PEM) determinants include protein and carbohydrate intake, housing and environmental status, father and mother's education and occupation, monthly income, socio-economic factors, dietary habits, family size, and anthropometric measures.*

Keywords: Prevalence, Determinants, Protein Energy Malnutrition, Children, Rural, Community

Introduction

Malnutrition refers to an inadequate supply of nutrients and energy to the body cells compared to the body's requirements for maintaining growth and ensuring daily functions of the body and is the major health burden in developing countries. Malnutrition is categorized as under-nutrition and over-nutrition. Undernutrition is divided into stunting, wasting, underweight, and protein deficiency (Dey, 2018).

According to the World Health Organization, Protein-energy malnutrition (PEM) refers to "an imbalance between the supply of protein and energy and the body's demand for them to ensure optimal growth and function(Black et al., 2013). It may manifest as either marasmus, a wasting disease due to lack of protein and overall calories, or kwashiorkor, which presents with generalized edema due to primary protein malnutrition. The term protein-energy malnutrition applies to a group of related disorders that include marasmus, kwashiorkor, and intermediate states of marasmus-kwashiorkor (Hulst et al., 2022).

Globally, there are 170 million protein-energy malnourished children under five. It accounts for at least half of all child deaths worldwide (Asim and Nawaz, 2018). Protein Energy Malnutrition also risks children's physical health and intellectual development, leading to poor academic performance (Salifu, 2021). It is estimated that 165 million (30%) of the world's children under 5 years of age are moderately underweight, and 110 million people (19%) are severely underweight.

According to the National Nutrition Survey, 33% of all children are underweight, about 44% stunted, 15% wasted, and 50% anemic (iron deficiency). Pakistan is one of the countries with the highest prevalence of child protein energy malnutrition than other developing countries(Ahmad et al., 2020). In our study community, Lakhodair, more than half of the children have protein energy malnutrition. Over the last 20 years, the prevalence of children has decreased slightly in Pakistan compared to other developing countries (Lawal et al., 2023). Despite economic and social development, child protein energy malnutrition remains a major social Health concern and social problem in developing countries (United Nations International Children's Emergency Fund (UNICEF)., 2018)(Sotiraki et al., 2022).

Nearly one in five children under age five in the developing world is underweight (MDG report, 2012), and it continues to be a primary cause of ill health and mortality among children. The World Health Organization (WHO) has reported hunger and related protein energy malnutrition as the greatest single threat to the world's public health. One in every three malnourished children worldwide has Protein-energy malnutrition, and protein-energy under-nutrition is a major cause of over half of under-five deaths (Addi et al.). A wise investment in a child's health, protein, energy, nutrition, and education is the foundation stone for the development of a country as a whole. The child population is the most important section of society, and their growth and development strongly reflect on a country's future. Infants and preschool children are most vulnerable to the vicious cycle of protein energy malnutrition, particularly undernutrition. Protein-energy malnutrition, a silent emergency, prevents children from reaching their full physical and mental potential, leading to delays in physical

growth and motor development, lower intellectual quotient, behavioral problems, and deficient social skills (Addi et al.). For children and adults, protein energy malnutrition refers to an imbalance of energy and nutrients in physical condition (Daryanani et al., 2023). Elimination of all forms of protein energy malnutrition is specified in the second Sustainable Development Goal (SDG) of the United Nations, with the ultimate goal being that every child be free from protein energy malnutrition. Regarding diet, prevalence (stunting, wasting, and underweight) increases the risk of illness and death. Community-level socio-economic factors play an important role in the prevalence and incidence of protein energy malnutrition (Randell et al., 2022). Gender inequality, education, poverty, sanitation, and safe access to water are key socio-economic factors driving health outcomes in many developing and underdeveloped countries(Zhang et al., 2022).

In our study, maternal low educational attainment and poverty can determine protein energy malnutrition. Restricted household states have the highest potential for social and economic development of physical growth problems due to the consumption of bad food(Siddiqui et al., 2020). Maternal higher education can reduce child protein-energy malnutrition by raising awareness of hygiene measures, Practices, and best resource Priority allocation to children. Socio-economic development and rate of reduction in child protein energy malnutrition can provide key insights to improve Living conditions in most developing countries(Chen et al., 2023). This study aims to determine the prevalence rate and determinants of protein energy malnutrition (PEM) among children under the age of five years in a rural community of Lahore.

This study aims to determine the prevalence rate of protein-energy malnutrition among children under the age of five in a rural community in Lahore and to identify the factors that contribute to protein-energy malnutrition in children under five in the same community.

Methodology

This study used a quantitative cross-sectional design to investigate 150 mothers with children under 5 in the rural community of Lakhodair in Lahore. The participants were selected using purposive sampling techniques. To ensure ethical considerations, the research followed the rules and regulations set by the ethical committee of Saida Waheed FMH CON Lahore. The participants' rights were also respected throughout the study.

The data was collected using pre-designed and pretested demographic and personal questionnaires, including information on age, sex, type of family, number of siblings, mother's literacy, father's educational level, socio-economic status, knowledge of mother regarding diet, housing condition, and environmental sanitation. Anthropometric measurements such as weight, height, chest, and head circumference were also collected. Prasad's scale was used to determine socio-economic status. All questionnaires were used after obtaining permission from the participants.

The Statistical Package for Social Sciences (SPSS) version 23 was used for data analysis, and descriptive statistics were

employed. Frequencies, means, and percentages were calculated using descriptive analysis techniques.

Results

This study included a total of 150 participants. Table 1 presents a snapshot of the demographic and family characteristics of the study participants. It categorizes children into age groups, with the majority falling into the 1.1-2 years category (42.7%). Gender distribution shows a slightly higher representation of females (56.7%). All families are located in rural areas. Family size ranges from 1-3 members to 9-12 members, with the largest group having 4-8 members (48%). Mothers' educational level varies, with most having completed under-graduation (60%). Fathers have diverse occupations, with farming being the most prevalent (50.7%). Mothers predominantly work as housewives (70.7%) (Figure 1). Monthly income is divided into three groups, with a significant portion falling into the 20,000 - 30,000 category (66.7%). These details offer a comprehensive understanding of the study population's background and context, which is crucial for interpreting research findings.
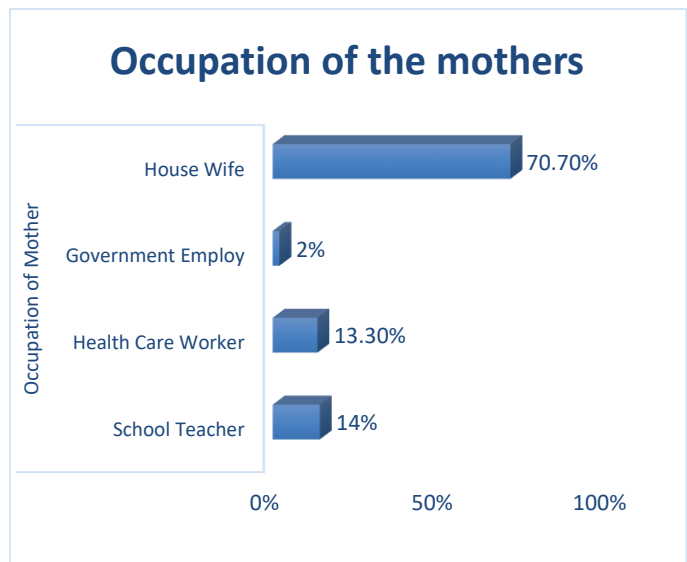
Figure 1: Distribution of occupation of mothers in the study population

Table 2 comprehensively overviews the studied population's various demographic, health-related, and dietary characteristics. The first paragraph highlighted the distribution of families based on their type, dietary patterns, housing and environmental sanitation conditions, and socio-economic status. Notably, most families fell into the joint family category, constituting 48% of the sample, followed by nuclear families at 34% and extended families at 18%. Regarding dietary patterns, a significant % of families (68.7%) adhered to a vegetarian diet, while 31.3% followed a non-vegetarian diet. The table also revealed housing and environmental sanitation information, showing that the majority (62.7%) had poor housing conditions, while only a

small fraction (4.7%) enjoyed good housing and sanitation. An even split was observed regarding socio-economic status, with 60% of the families categorized as poor and 40% as middle-class.

Among dietary habits, only 4% of families had a diet with protein and carbohydrates accounting for less than 50% of their intake, while 28.7% had a diet with more than 50% protein and carbohydrates. Notably, 86% of families reported no pregnancy complications linked to Protein-Energy Malnutrition (PEM), while 14% indicated experiencing such complications. In terms of mode of delivery, 68% of families had normal deliveries, and 32% had Lower Segment Caesarean Sections (LSCS). In immunization, 54.7% of families were fully immunized, 18% were partially immunized, and 27.3% remained unimmunized. Additionally, the table provided insights into the anthropometric measures, revealing variations in weight, height, mid-arm circumference, head circumference, and chest circumference. These data were instrumental in assessing the health and nutritional status of the families in the study.

All the anthropometric measures were summed up, and poor community or class and prevalence rate was calculated by dividing with the population equal to 4.22%. Factors affecting Protein-energy malnutrition in children under 5 years of age children in a rural community include Protein and Carbohydrate Intake, Housing and Environmental status, Father and mother education and Occupation, Monthly Income, Socio-economic factors, dietary habits, Family Size, Anthropometric measures matters.

Table 1: Demographics and Family Characteristics

Variables	Construct	Number (n)	Percent (%)
Age of child?	< 1 year	43	28.7%
	1.1-2 years	64	42.7%
	2.1-4 years	43	28.7%
Gender of child	Male	65	43.3%
	Female	85	56.7%
Area	Urban	0	0%
	Rural	150	100%
Family Size	1-3 members	6	4.0%
	4-8 members	72	48%
	9-12 members	16	10.7%
Mother's Educational Level	Illiterate	58	38.7%
	Under Graduation	90	60%
	Graduation	2	1.3%
Father's Occupation	Microfinance	6	4%
	Government Employ	43	28.7%
	Factory Worker	25	16.7%
	Farmer	76	50.7%
Occupation of Mother	School Teacher	21	14%
	Health Care Worker	20	13.3%
	Government Employ	3	2%
	House Wife	106	70.7%
Monthly Income	20,000 – 30,000	100	66.7%
	31,000 – 40,000	46	28%
	Above 40,000	8	6%

Table 2: Family and Health-Related Variables

Variable	Option	Number (n)	Percent (%)
Type of Family	Nuclear	51	34%
	Joint	72	48%
	Extended	27	18%
Dietary Pattern of Family	Vegetarian	103	68.7%
	Non-Vegetarian	47	31.3%
Housing & Environmental Sanitation	Poor	62	62.7%
	Satisfactory	32	32.7%
	Good	4	4.7%
Socio-economic Status	Poor	60	60%
	Middle Class	40	40%
Dietary Habits of Family	Protein + carbohydrate <50%	4	4%
	Protein + Carbohydrate >50%	28	28.7%
Pregnancy Complications and PEM	Yes	14	14%

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	No	86	86%
Mode of Delivery and PEM	Normal Delivery	102	68%
	LSCS	48	32%
Immunization and PEM	Fully Immunized	82	54.7%
	Partially Immunized	27	18%
	Unimmunized	41	27.3%
Anthropometric Measures	Weight		
	Overweight	14	9.3%
	Underweight	12	8%
	Average	114	76%
	Height		
	Normal	68	45.3%
	Less than normal	82	54.7%
	Mid-arm Circumference (MAC)		
	Normal	29	19.3%
	Less than normal	121	80.7%
	Head Circumference		
	Normal	15	10%
	Less than normal	135	90%
	Chest Circumference		
	Normal	16	10.7%
	Less than normal	134	89.3%

Discussion

Protein Energy Malnutrition is a very important issue to address as it is related to children's growth and has a pivotal role in pediatric health. Most commonly seen in (Likis et al., 2014) children less than 5 years of age. Pakistan is a developing country confronting grave concerns, including corruption in the distribution of resources. The Health Budget is minimal in the government setup, and inflation is touching the sky nowadays. Poverty is seen in most of the population, and unemployment is rising. Several demographic factors, as well as environmental factors, affect pediatric health as well as mothers' health (Schmidt et al., 2016).

Malnutrition can be seen in underweight mothers and children when these mothers deliver babies with weight less than normal. Protein-energy malnutrition leads to rickets, marasmus, etc., due to protein deficiency and other nutrients essential for children's growth (Akombi et al., 2017).

The present study revealed that the prevalence rate of protein energy malnutrition was 4.22% in the Lakhdhir community of Lahore, Pakistan. In our study, 43% of male and 57% of female children were included who were malnourished. The age limit of malnourished children includes children <1 year of age was 28.7%, 42.7% were within 1.1-2 years of age, and 28.7% were within 2.1-4 years, respectively. Family size consisted of categories depending on the number of members in the family. 41% were 1-3 members, 48% were 4-8, and 10.7% were 9-12 family members. The majority have large family sizes, a factor of Protein Energy Malnourishment (PEM) in children under 5.

Mothers' education: 39% were illiterate, 60% were undergraduate, and 1% were graduate. It means the majority were uneducated, which means they didn't know about healthy and essential nutrients. Regarding the mother's occupation, 14% were teachers, 13.333% were teachers, 2% were government employees, and 70.667% were housewives. Including fathers' occupation, 50.667% were farmers, 28.667% were govt. Of the employees, 4% were from the microfinance department, and 16.667% were factory workers.. 28% have a salary of 21-30K, 66.667% have a monthly income of up to 10-20K, and 4% have monthly income >40K. It is revealed that unemployment or salary package was unsatisfactory, an environmental or demographic factor of PEM.

48% were from joint families, 34% were from nuclear families and 18% were from extended families. 31% non-vegetarian and 69% were vegetarian. 32.67% had satisfactory housing and environment, 4.7% had good housing and 62.67% had poor housing and environment. Poor housing and environment lead to different infections and communicable diseases.

60% were from low-income people, and 40% from the middle class. 17.333% have protein+ carbohydrate intake > 50%, and 82.667% have dietary habits of family < 50% of protein and carbohydrate intake. The class difference is evident, and the majority is poor; that's why facing PEM. Similar findings were seen in the past study with different populations(Chen et al., 2011; Millet et al., 2011)

For pregnancy complications and PEM, 69.333% responded yes, and 30.667% had no answer. 34.667%, an average of 64.667%, were underweight, showing they had experienced protein energy malnutrition. 78% were those children having less height than normal due to having less carbohydrate and protein intake. 22% were normal. Mothers don't have money to take the multivitamins or have investigational labs to rule out the changes or complications inside the mother during pregnancy, which can be arrested after the prescription of the best gynecologist. So, the investment should be made for mother health as done by the redeveloped countries (Barrett et al., 2015; Warnick et al., 2004).

6% normal and 94% abnormal mid-arm circumference (MAC) as per their age. 80.667% have a head circumference less than normal, and 19.333 % have a normal head circumference. Chest circumference as per child age 88.667% show less than normal and 11.333% normal. Head,

chest, and mid-arm circumferences were seen as less than normal, showing that protein energy malnourishment leads to these complications in children.

A study with similar results was conducted in Pakistan by Bhatti et al. 2021. Factors affecting Protein-energy malnutrition in children under 5 years of age children in a rural community include Protein and Carbohydrate Intake, Housing, Environmental status, Father and mother education and Occupation, Monthly Income, Socio-economic factors, dietary habits, Family Size, Anthropometric measures matters (Bhatti et al., 2021).

Conclusion

It was concluded that the prevalence rate was 4.22%. Factors affecting Protein-energy malnutrition in children under 5 years of age children in a rural community include Protein and Carbohydrate Intake, Housing, Environmental status, Father and mother education and Occupation, Monthly Income, Socio-economic factors, dietary habits, Family Size, Anthropometric measures matters.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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