Exploring the Complex Socio-Demographic Dynamics of Underweight Children between 1 to 5 years: A Comprehensive Analysis of a Sample Population

[1]Dr. Anjan Roy, [2]Dr. Amiya Nand Dev Goswami, [3]Dr. Rupali Bhaduri, [4]Dr. Rayba Khatoon

[1]HOD and Reader, Ph.D. (Homoeopathy) Scholar, [1]Department of Surgery
[1]The Calcutta Homoeopathic Medical College & Hospital (Govt. of WB), Kolkata, India
[2]Professor & HOD, Dept. of Organon of Medicine, Rajasthan Vidyapeeth Homoeopathic Medical College & Hospital
[3]Reader, Dept. of Practice of Medicine, The Calcutta Homoeopathic Medical College & Hospital (Govt. of WB)
[4]PG Scholar, Practice of Medicine, The Calcutta Homoeopathic Medical College & Hospital (Govt. of WB)

Abstract- **This article delves into an examination of malnutrition in children under the age of 5 within a group of 120 individuals. The research explores socio-demographical factors that impact malnutrition highlighting how prevalent it is across various groups. The data indicates a gender gap, with males making up 66.66% of children. Moreover, there is an occurrence of malnutrition among children aged between 49 to 60 months. Factors like birth order and interval between births also play roles showing that second born children and those born less than 33 months apart are more vulnerable. Additionally, the number of siblings in the family, mother's age at childbirth and the educational levels of both parents show varying levels of correlation with malnutrition. These results underscore the necessity of considering these elements when crafting targeted interventions to combat malnutrition in children. Recognizing the socio-demographical aspects contributing to malnutrition is essential, for developing effective public health strategies and policies aimed at enhancing child nutrition outcomes.**

Keywords: **Malnutrition, Odd's ratio, anthropometric measurements, skin fold thickness, Z-score.**

INTRODUCTION:

Malnutrition is a health condition resulting from eating food that contains either insufficient or too many calories, carbohydrates, vitamins, proteins or minerals.[1,2] Good nutrition is the basic need for children to thrive, grow, learn, play and participate. Every child has the right of basic nutrition, shelter, basic healthcare services and social services that are related to the best interests of the child.[3] Children are more vulnerable to macro- and micronutrient deficiencies caused by high demand for food during their years of growth.[4,5] Malnutrition is the most severe consequence of food insecurity amongst children under the age of 5 years. Acute malnutrition can lead to morbidity, mortality and disability, as well as impaired cognitive and physical development with an increased risk of concurrent infections. Physical and mental health development is a fundamental right of a child, and their optimum level of health can be accessed with good nutritional support.[6] Causes of malnutrition can be reduced dietary intake, reduced absorption of macro- and/or micronutrients, increased losses or altered requirements and increased energy expenditure.[7] Malnutrition affects the function and recovery of every organ system. Weight loss due to depletion of fat and muscle mass, including organ mass, is often the most obvious sign of malnutrition. Muscle function declines before changes in muscle mass occur, suggesting that altered nutrient intake has an important impact independent of the effects on muscle mass.[8] Reduction in cardiac muscle mass resulting, decrease in cardiac output has a corresponding impact on renal function by reducing renal perfusion and glomerular filtration rate. Micronutrient and electrolyte deficiencies may also affect cardiac function, particularly during refeeding. Chronic malnutrition results in changes in pancreatic exocrine function, intestinal blood flow, villous architecture and intestinal permeability. The colon loses its ability to reabsorb water and electrolytes, and secretion of ions and fluid occurs in the small and large bowel. Immune function is also affected, increasing the risk of infection due to impaired cell-mediated immunity and cytokine, complement and phagocyte function.[8]

Malnutrition is associated with a higher mortality rate among preschool children. Nearly half of the preschool children were underweighting and stunted in India, as documented by the National Family Health Survey (NFHS)- 4 and 5 reports, and 41.9% of preschool children (per 1,000 live births) lost their lives before attaining their fifth birth day.[9] More than one-third of the world's wasted and stunted children live in India. According to the NFHS-3 of India, 60% of preschool tribal children were underweight.[10]

A cross-sectional study on tribal preschool children (aged 2-5-years) found significant in age variations in mean weight and height observed in both sexes ($p<0.001$) with overall prevalence of malnutrition were more among boys (85.71%) than girls (76.4%). Overall, about 37.5% of preschool children were severely malnourished.[10]
A study conducted in South Africa found child malnutrition under the age of 5 years has a great influence on the cultural, socioeconomic and community food practices and is directly influenced by maternal health during pre-pregnancy, pregnancy and breastfeeding.[11]
Another study conducted in Pakistan found no difference in overall malnutrition between male and female children with no significant difference ($p>0.05$) in the prevalence of mild and moderate malnutrition but, the prevalence of severe malnutrition was significantly high in female children.[12]
Patil GR et al found prevalence of Protein energy malnutrition is 67.7% among 1-5 years which is high among rural children (71.1%) compared to urban children (64.4%) and this difference was found to be statistically significant.[13]
Prasot RM et al found that more than half (54.8%) of children of age 1-6 years were underweight and prevalence of PEM was higher in children of 1-3 years of age group, female sex, Hindu religion, schedule caste, nuclear family, children having ≥3 siblings, illiterate father, lower socioeconomic status, poor housing and sanitation.[14]
Sharma SP et al in their study observed statistically significant difference in nutritional status of the children and mothers occupation only in case of stunting ($p <0.05$).[15]

MATERIAL AND METHODS:

Present findings are part of the study of Ph.D. in Homoeopathy with a prospective, interventional, double-arm, cross-over research design as a quantitative research method at Rajasthan Vidyapeeth Homoeopathic Medical College and Hospital, Dabok under Janardan Rai Nagar RV (Deemed University), Udaipur, Rajasthan with the objective to assess the improvement in nutritional status of the children less than 5 years with constitutional Homoeopathic medicines taking weight as the primary objective.

RESULTS:

The following data are given in tables with their interpretations in figures. Children were screened with anthropometric measurements like height, weight, mid upper arm circumference, head and chest circumferences, subscapular and triceps skin fold thickness. Only underweight children were enrolled whose Weight-for-age Z-score was between -2SD to -3SD.

Variable	Sample size between -2SD to-3SD	Frequency in number (in %)
Child Sex	Male	80 (66.66)
	Female	40 (33.33)
Child Age	13 - 24 Months	3 (2.5)
	25 - 36 Months	6 (5)
	37 - 48 Months	49 (40)
	49 - 60 Months	62 (51)
Birth order	First Born	39 (32.5)
	Second Born	42 (40)
	Third Born	33 (27.5)
Birth Interval	At 33 Months	13 (10.83)
	Less than 33 Months	32 (26.66)
	More than 33 Months	36 (30)
Number of Children	1 – 2	76 (63.33)
	3 – 4	44 (36.66)
Mother's age at birth	Less than 18 years	34 (28.33)
	18-29 years	60 (50)
	30-40 years	26 (21.66)
Mother's education level	Primary	48 (40)
	Secondary	23 (19.1)
	University/Tertiary	11 (9.1)
	No education	38 (31.6)
Father's education level	Primary	27 (22.5)
	Secondary	38 (31.66)

	University/Tertiary	25 (20.83)
	No education	30 (25)
Mother's occupation	House Wife	74 (61.66)
	Government employee	13 (10.33)
	NGOs employee	12 (10)
	Retail business	17 (14.16)
	Teacher	4 (3.33)
Father's occupation	Cattle keeper	27 (17.5)
	Casual worker	39 (37.5)
	Government employee	31 (25.83)
	NGOs Employee	11 (9.1)
	Teacher	12 (10)
Family type	Nuclear Family	43 (35.83)
	Extended Family	77 (64.16)

Table 1: Socio Demographic Profile of the Study Population

The research discovered a contrast, in odds ratios for malnutrition between genders. Male children were found to have 2.14 times odds of experiencing malnutrition compared to female. This indicates a gender susceptibility to malnutrition among the group under study. The bar graph illustrates the odds ratio pertaining to child gender highlighting the disparity in malnutrition outcomes, among children aged below 5 years (Fig 1).

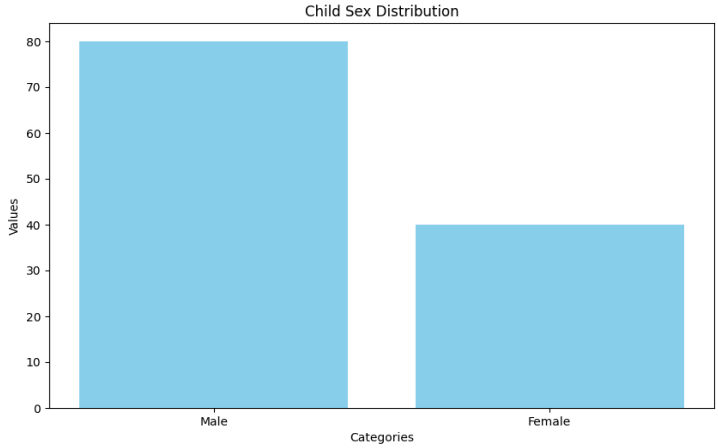

Figure 1: Child sex distribution

In our comprehensive analysis of malnutrition among children under 5 years old, we turn our attention to the variable of child age. This critical aspect of our study aims to unravel the nuanced relationship between age categories and the prevalence of malnutrition, shedding light on potential vulnerabilities within specific age groups.To quantify the association between child age and malnutrition, we employ the odds ratio calculation method. This statistical approach allows us to compare the odds of malnutrition between different age categories, providing valuable insights into the varying levels of susceptibility (Fig 2).

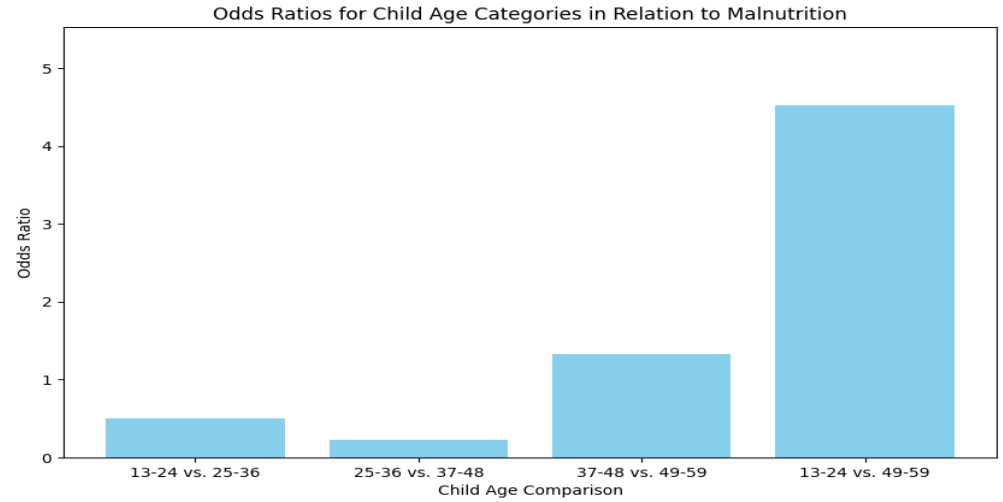

Figure 2: Comparison between age groups

In exploring the impact of birth order on malnutrition among children under 5, we examine the odds ratios for each category within this variable. For second-born children compared to first-borns, the odds ratio is approximately 1.25, indicating a 25% higher likelihood of malnutrition. Conversely, third-born children exhibit an odds ratio of approximately 0.77 when compared to first-borns, suggesting a 23% lower likelihood. Additionally, the odds ratio for third-born versus second-born children is approximately 0.62, highlighting a 38% reduced likelihood of malnutrition in the third-born group compared to their second-born counterparts. These findings illuminate the nuanced relationship between birth order and malnutrition, emphasizing the need for targeted interventions based on the specific dynamics within each birth order category (Fig 3).

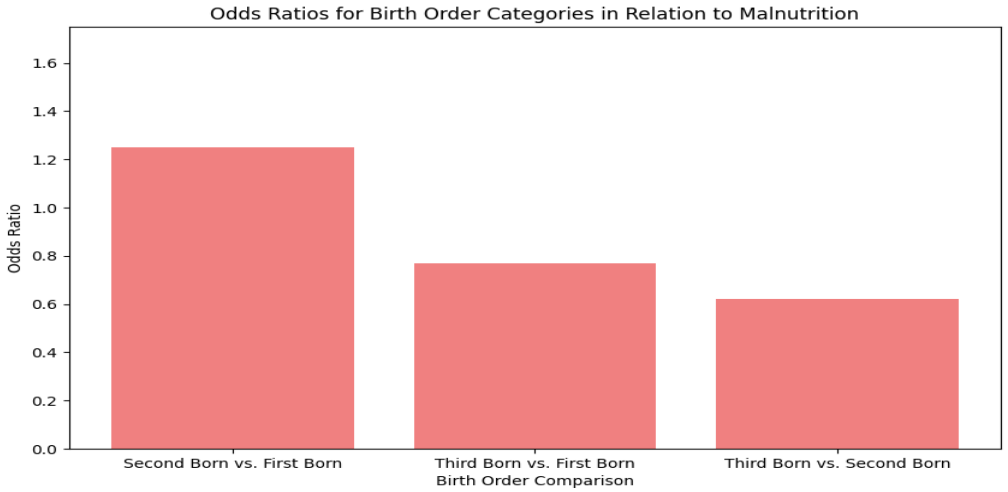

Figure 3: Comparison between birth orders

In assessing the impact of birth interval on malnutrition among children under 5, odds ratios reveal distinctive patterns. Comparing children born less than 33 months apart to those born at 33 months, the odds ratio is approximately 2.49, indicating a 149% increased likelihood of malnutrition. Furthermore, children born more than 33 months apart versus those born at 33 months exhibit an odds ratio of approximately 3.43, signifying a 243% higher likelihood of malnutrition. Notably, when comparing children born more than 33 months apart to those born less than 33 months apart, the odds ratio is approximately 1.35, suggesting a 35% elevated likelihood of malnutrition. These findings emphasize the critical role of birth interval in influencing the risk of malnutrition among children under 5, underscoring the importance of targeted interventions based on specific birth interval categories (Fig 4).

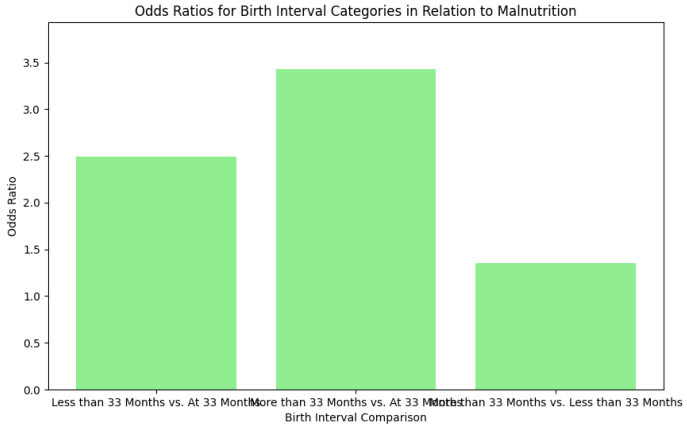

Figure 4: Odds ratio for birth interval

Analysing the odds ratio for malnutrition based on the number of children in a family, the comparison between families with 3-4 children and those with 1-2 children reveals an odds ratio of approximately 0.55. This indicates a 45% reduced likelihood of malnutrition in families with 3-4 children compared to those with 1-2 children. These findings shed light on the complex interplay between family size and malnutrition risk, underscoring the need for nuanced interventions that consider the specific dynamics associated with varying numbers of children in a household (Fig 5).

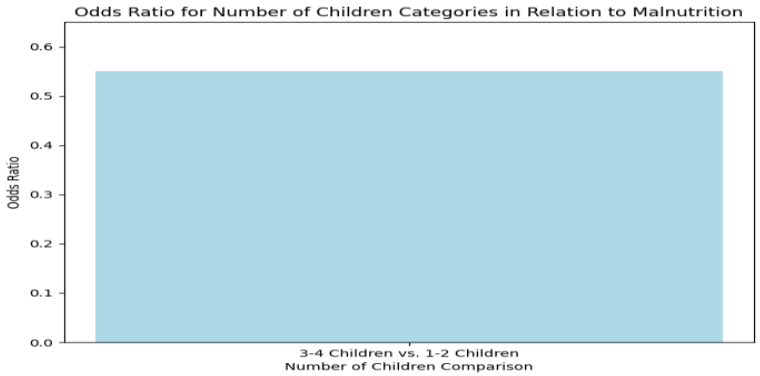

Figure 5: Odds ratio for number of children in the family

Examining the odds ratios for malnutrition in relation to the mother's age at birth, intriguing patterns emerge. Comparing mothers aged 18-29 years to those younger than 18 years, the odds ratio is approximately 1.85, suggesting an 85% higher likelihood of malnutrition. In contrast, comparing mothers aged 30-40 years to those younger than 18 years yields an odds ratio of approximately 0.70, indicating a 30% reduced likelihood. Additionally, comparing mothers aged 30-40 years to those aged 18-29 years results in an odds ratio of approximately 0.93, suggesting a 7% lower likelihood. These findings highlight the intricate relationship between the mother's age at birth and malnutrition risk, emphasizing the need for tailored interventions that consider the diverse age groups of mothers (Fig 6).

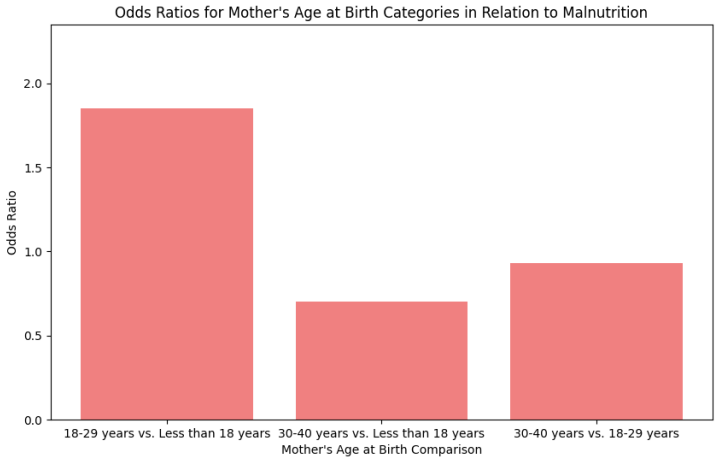

Figure 6: Odds ratio for mother's age at birth

Analyzing the odds ratios for malnutrition concerning the mother's educational level unveils distinctive patterns. In comparison to mothers with primary education, those with secondary education exhibit an odds ratio of approximately 0.44, signifying a 56% lower likelihood of malnutrition. Similarly, mothers with university/tertiary education, in contrast to those with primary education, show an odds ratio of around 0.21, indicating a substantial 79% reduced likelihood of malnutrition. Conversely, mothers with no education, when compared to those with primary education, present an odds ratio of approximately 1.04, suggesting a 4% higher likelihood of malnutrition. These findings underscore the significant influence of maternal educational attainment on childhood malnutrition, underscoring the need for targeted interventions based on educational levels (Fig 7).

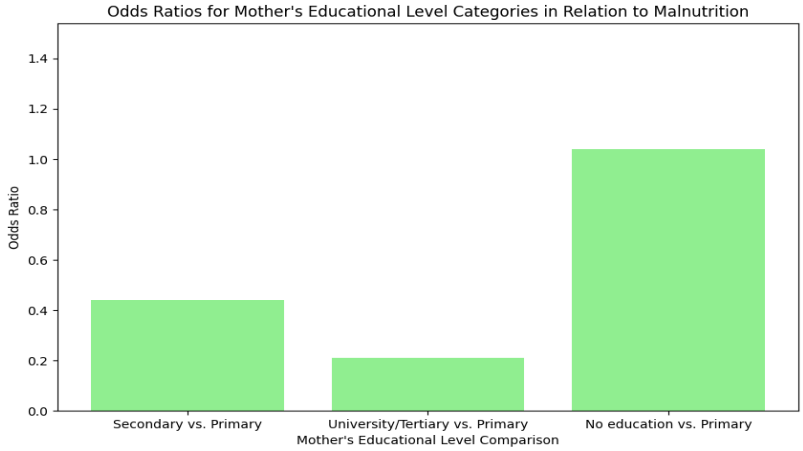

Figure 7: Odds ratio for mother's educational level

Examining the odds ratios for malnutrition with respect to the father's education level reveals noteworthy insights. In comparison to fathers with primary education, those with secondary education demonstrate an odds ratio of approximately 1.38, indicating a 38% higher likelihood of malnutrition. Conversely, fathers with university/tertiary education, when compared to those with primary education, display an odds ratio of around 0.96, suggesting a marginal 4% decrease in the likelihood of malnutrition. Notably, fathers with no education, relative to those with primary education, exhibit an odds ratio of approximately 1.15, signifying a 15% higher likelihood of malnutrition. These findings emphasize the potential impact of paternal education on childhood malnutrition, emphasizing the need for targeted interventions based on varying levels of paternal educational attainment (Fig 8).

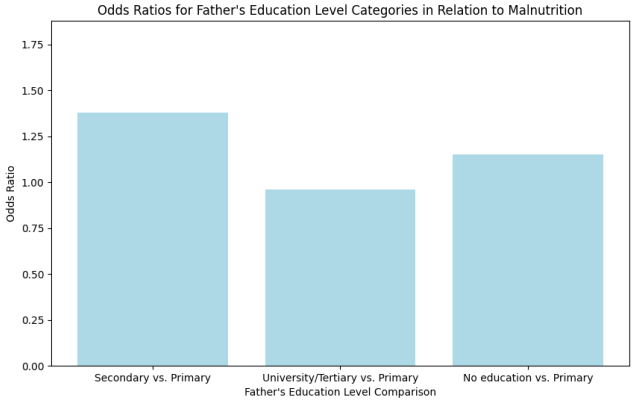

Figure 8: Odds ratio for father's educational level

Analysing the odds ratios for malnutrition concerning the mother's occupation reveals interesting patterns. When compared to housewives, government employees exhibit an odds ratio of approximately 0.16, indicating a 16% lower likelihood of malnutrition. Similarly, NGOs employees and individuals engaged in retail business demonstrate odds ratios of approximately 0.15 and 0.22, respectively, suggesting lower probabilities of malnutrition compared to housewives. Teachers, relative to housewives, display an odds ratio of around 0.14, indicating a 14% lower likelihood of malnutrition. These findings underscore the potential influence of maternal occupation on childhood malnutrition, emphasizing the need for targeted interventions based on different occupational categories (Fig 9).

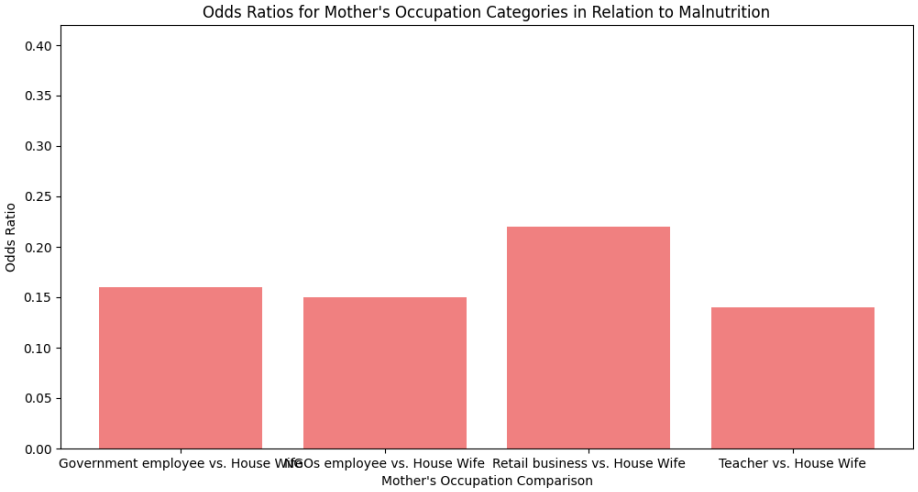

Figure 9: Odds ratio for mother's occupation

Analysing the odds ratios associated with paternal occupation and childhood malnutrition, the study reveals distinct patterns. Casual workers exhibit a 46% higher likelihood of child malnutrition compared to cattle keepers, while government employees show a marginal increase. Conversely, NGOs employees and teachers demonstrate lower odds, indicating a reduced likelihood of malnutrition. These findings emphasize the nuanced influence of paternal occupation on child health outcomes, highlighting the need for tailored interventions addressing specific occupational contexts.

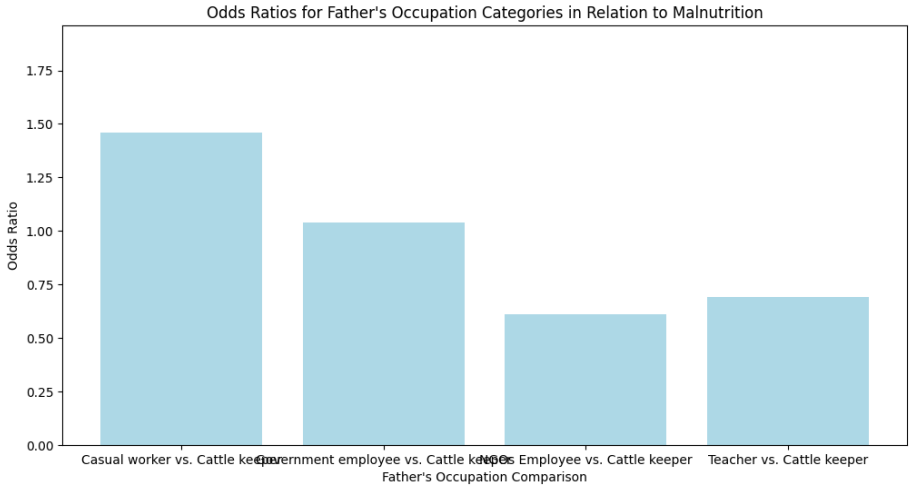

Figure 10: Odds ratio for father's occupation

Examining the odds ratios associated with family types and childhood malnutrition, the study indicates a significant difference. Children in extended families exhibit a 2.56 times higher likelihood of malnutrition compared to those in nuclear families. This suggests a potential association between family structure and child nutritional outcomes, emphasizing the need for targeted interventions within specific familial contexts (Fig 11).

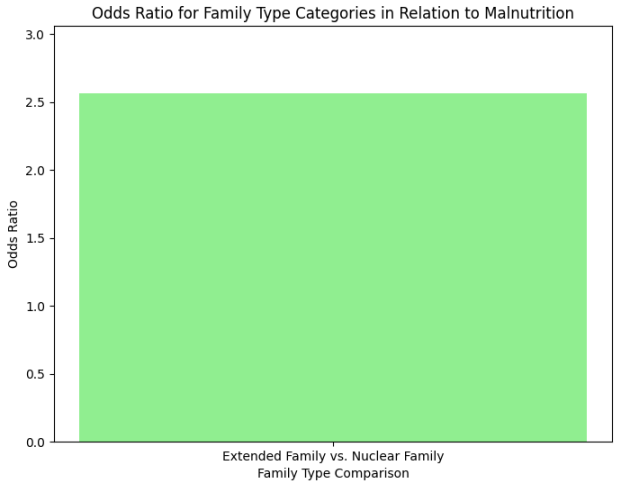

Figure 11: Odds ratio for family type

Disease	At enrolment	Frequency during study	Homoeopathic intervention needed	At the end of 12 months
Acute Gastro Enteritis	Case- 14 Control- 19	Case- 02 Control- 11	Case- 01 Control- 03	Case- 03 Control- 07
Fever	Case- 09 Control- 11	Case- 11 Control-19	Case- 04 Control- 04	Case- 10 Control- 12
Cough/ARI	Case- 09 Control- 11	Case- 05 Control- 13	Case- 03 Control- 09	Case- 05 Control- 14
Pain Abdomen	Case- 16 Control- 07	Case- 04 Control- 12	Case- 02 Control- 08	Case- 04 Control- 07

Table: 2: Homoeopathic intervention at different time

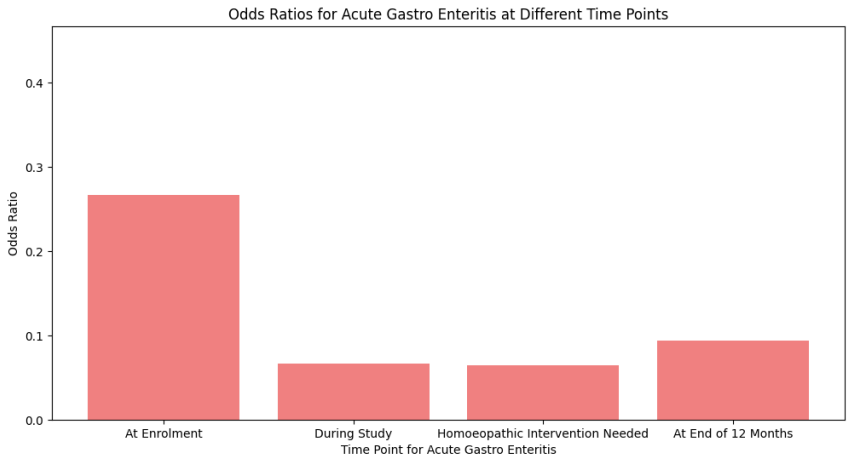

Figure 12: Homoeopathic intervention for Acute Gastro Enteritis

Homoeopathic intervention consistently showed lower odds of Acute Gastro Enteritis at different study points: 0.267 at enrolment, 0.067 during the study, 0.065 when intervention was needed, and 0.094 at the end of 12 months (Fig 12).

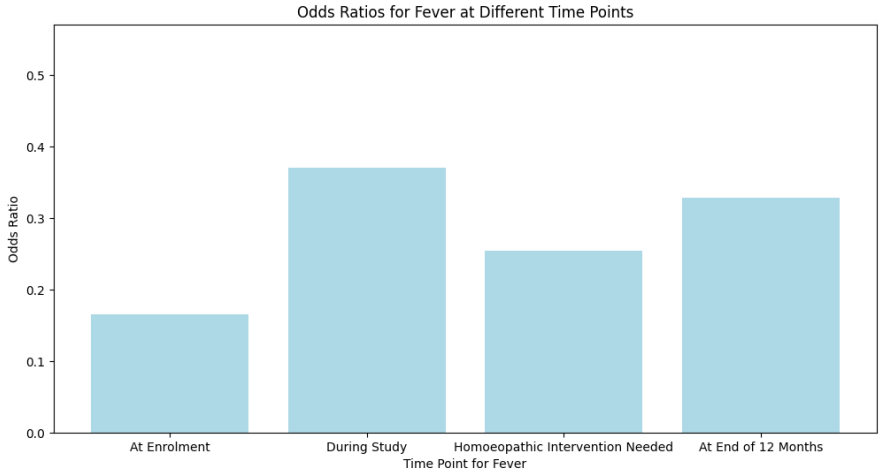

Figure 13: Homoeopathic intervention for fever

Homoeopathic intervention consistently demonstrated lower odds of fever across different study phases: 0.165 at enrolment, 0.371 during the study, 0.254 during intervention, and 0.329 at the end of 12 months (Fig 13).

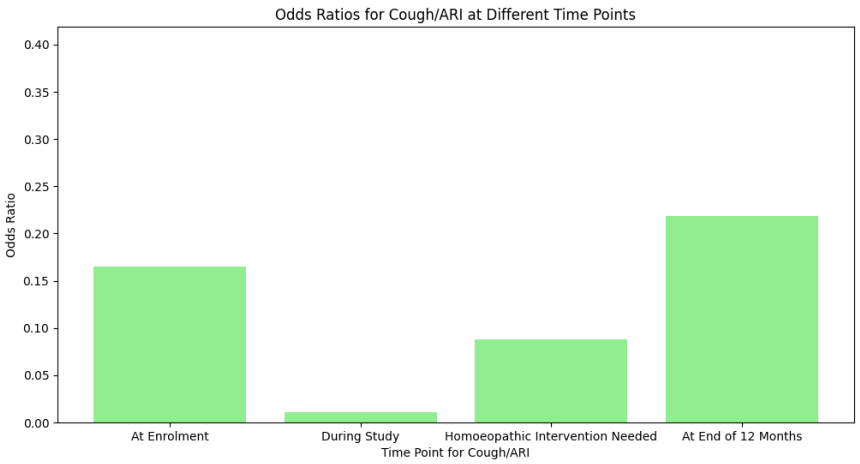

Figure 14: Homoeopathic intervention for cough/ARI

Homoeopathic intervention exhibited varying odds ratios for cough/ARI, indicating potential effectiveness: 0.165 at enrolment, 0.011 during the study, 0.088 during intervention, and 0.219 at the end of 12 months (Fig 14).
The odds ratios for pain abdomen showed distinct patterns: 2.27 at enrolment, 0.141 during the study, 0.128 during homoeopathic intervention, and 0.567 at the end of 12 months, highlighting potential benefits in pain management through homoeopathic intervention (Fig 15).

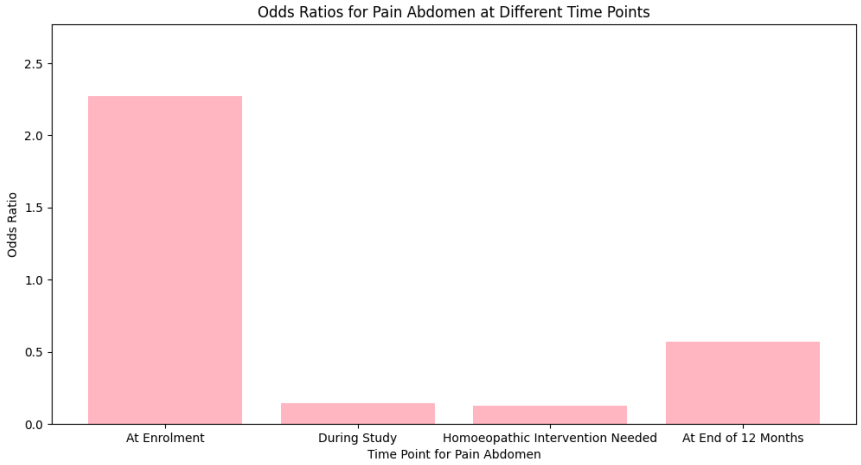

Figure 15: Homoeopathic intervention for pain in abdomen

DISCUSSION

Our study looked closely at malnutrition in children under 5 years of age and found that various social and demographic factors play a role. Interestingly, we noticed a big difference between boys and girls, with 66.66% of malnourished kids being boys. This highlights the importance of tailoring interventions specifically for boys in our group. Singh SP et al [16] was found almost equal gender wise distribution among male 209(50.7%) and females 203(49.3%) in their study. But Prasot RM et al [15], Kumar T et al [17] and Chakraborty S et al [18] were found more in females.
The age of the child also matters a lot. We found a very higher prevalence of malnutrition in children aged 49-60 months. In other studies researchers observed malnutrition was significantly more prevalent in younger age groups. [13, 14, 18]

Birth order and the time between births turned out to be important. First-born kids and those born less than 33 months after their sibling are more likely to face malnutrition. This means we should have targeted interventions for these specific situations.
Family type matters too. Extended families had a much higher chance of malnutrition compared to nuclear families. This suggests we need different strategies for dealing with malnutrition based on the type of family.
Additionally, the age when a mother gives birth, the education levels of both parents, and the father's occupation were all linked to malnutrition. These findings show how complicated it is when different social and demographic factors come together to affect a child's nutrition.

CONCLUSION

It's important to know the details of how different social and demographic factors contribute to malnutrition. This information is crucial for creating effective public health plans. The odds ratios calculated for each factor give us useful insights into how different things affect the risk of malnutrition. These findings highlight the need for focused actions that take into account gender-related vulnerabilities, age-related risks, birth order, family dynamics, and parental characteristics.
By recognizing and dealing with the specific social and demographic factors found in this study, we can make our interventions more precise and effective. This, in turn, will help to improve the nutrition of children in our population.

AKNOWLEDGEMENT

We express gratitude to study participants, field researchers, local communities, institutions, peer reviewers, and community leaders for their invaluable contributions to our research on childhood malnutrition. Their support, cooperation, and expertise have been crucial to this study.
Funding: No funding sources.
Conflict of interest: None declared.
Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCES:

1. Davis JN, Oaks BM, Engle-Stone R. The double burden of malnutrition: A systematic review of operational definitions. Curr Dev Nutr. 2020;4(9):1–14. 10.1093/cdn/nzaa127
2. Zhang N, Ma G. Interpretation of WHO guideline: Assessing and managing children at primary health-care facilities to prevent overweight and obesity in the context of the double burden of malnutrition. Glob Heal J. 2018;2(2):1–13. 10.1016/S2414-6447(19)30136-8
3. South African Government . The constitution of the Republic of South Africa [homepage on the Internet]. 2021. Available from: https://www.gov.za/documents/constitution-republic-south-africa-1996
4. Clark H, Coll-Seck AM, Banerjee A, et al.. A future for the world's children? A WHO–UNICEF–Lancet Commission. Lancet. 2020;395(10224):605–658. 10.1016/S0140-6736(19)32540-1
5. Pomati M, Nandy S. Assessing progress towards SDG2: Trends and patterns of multiple malnutrition in young children under 5 in West and Central Africa. Child Indic Res. 2020;13(5):1847–1873. 10.1007/s12187-019-09671-1
6. Koetaan D, Smith A, Liebenberg A, et al.. The prevalence of underweight in children aged 5 years and younger attending primary health care clinics in the Mangaung area, Free State. African J Prim Heal Care Fam Med. 2018;10(1):1–5. 10.4102/phcfm.v10i1.1476
7. Stratton R, Green CJ, Elia M. Disease-related malnutrition: an evidence-based approach to treatment. Oxon: Cabi Publishing, 2003.
8. Green CJ. Existence, causes and consequences of disease-related malnutrition in the hospital and the community, and clinical and financial benefits of nutrition intervention. Clin Nutr 1999;18(Suppl 2):3–28.
9. National Family Health Survey (NFHS-5), India, 2019-21. Ministry of Health and Family Welfare, Govt. of India, International Institute for Population Sciences, Deonar, Mumbai. Available at: https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf (Accessed on 29/02/2024).
10. Mahata LL, Biswas S, Bisai S. Prevalence of malnutrition using anthropometric index among the Sabar tribal preschool children of Purulia District of West Bengal, India. Anthropol Open J. 2023; 6(1): 1-7. doi: 10.17140/ANTPOJ-6-132
11. Govender I, Rangiah S, Kaswa R, Nzaumvila D. Malnutrition in children under the age of 5 years in a primary health care setting. S Afr Fam Pract. 2021;63(1), a5337. https:// doi.org/10.4102/safp. v63i1.5337
12. Laghari ZA, Soomro AM, Tunio SA, Lashari K, Baloach FG, Baig NM, et al.Malnutrition among children under five years in District Sanghar, Sindh, Pakistan. Gomal J Med Sci 2015; 13: 54-7
13. Patil GR, Divyarani DC. Prevalence of protein energy malnutrition among 1-5 years of children in Bellary taluk. Int J Contemp Pediatr 2015;2:307-10
14. Prasot RM, Verma SK, Kashyap S, Kanaujiya MK. An epidemiological study of Protein Energy Malnutrition (PEM) among 1-6 years children in rural Lucknow, Uttar Pradesh, India. IOSR Journal of Dental and Medical Sciences. 2015;13(3):10-14
15. Sharma SP, Bhatnagar R , Kumar A, Meena N, Chawala G, Choudhary M. Assessment of Malnutrition in Pre-School children visiting immunization clinic, Maharana Bhoopal Hospital, Udaipur (Rajasthan). J Res Med Den Sci. 2014;2(1):88-91
16. Singh SP. Malnutrition among primary school children in Hyderabad, Andhra Pradesh, India. International Journal of Technical Research and Applications. 2014;2(1):36-39
17. Kumar T, Deswal BS. An epidemiological study of protein energy malnutrition among children below six years' age in an urban slum of Gurgaon, Haryana, India. Int J Community Med Public Health 2016;3: 2431-6.
18. Chakraborty S, Gupta SB, Chaturvedi B, Chakraborty SK. A Study of Protein Energy Malnutrition (PEM) in Children (0 to 6 Year) in a Rural Population of Jhansi District (U.P.). Indian Journal of Community Medicine. 2006;31(4):291-29