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Sociodemographic and Economic Factors Associated with Acute Diarrhea in Children under Five Years in District Headquarters Hospital, Sheikhpura

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ABSTRACT:

Objective: This study examined the association of socio-demographic and economic factors with acute diarrhea among under-five children at DHQ Hospital, Sheikhpura.

Methods: A six-month case-control study included 200 cases (children with acute diarrhea) and 200 controls (without diarrhea in the preceding 14 days) recruited through consecutive non-probability sampling. Data were collected using a validated Urdu questionnaire on socio-demographic and economic characteristics. Associations were analyzed using chi-square tests with odds ratio (OR) and 95% confidence intervals (CI) at $p \leq 0.05$.

Results: Male children were nearly twice as likely to develop diarrhea compared with females (OR = 1.99, 95% CI: 1.34–2.92, $p < 0.001$). Younger children (0–29 months) were more vulnerable than those aged 30–59 months (OR = 0.57, 95% CI: 0.36–0.90, $p = 0.02$). Maternal age ≤ 30 years (OR = 1.65, 95% CI: 1.10–2.47, $p = 0.015$) and non-formal maternal education (OR = 5.42, 95% CI: 3.25–9.03, $p < 0.001$) significantly increased risk. Low household income ($< 25,000$ PKR) was the strongest predictor (OR = 12.0, 95% CI: 7.46–19.33, $p < 0.001$). Rural residence (OR = 1.69, $p = 0.01$) was also independently associated.

Conclusions: Diarrhea risk in under-five children is strongly influenced by male sex, low maternal education, and poverty. Improving maternal education, rural sanitation, and implementing poverty-reduction strategies are essential to reduce the diarrhea burden in Pakistan.

1. INTRODUCTION

Acute diarrhea remains one of the leading causes of morbidity and mortality among children under five years worldwide, despite significant advances in public health and child survival programs (Lanata et al., 2013). It is the second-leading cause of death in this age group, according to the World Health Organization, killing an estimated half a million children annually, with the greatest burden in low- and middle-income countries (LMICs) (Hartman et al., 2023). Beyond mortality, repeated episodes lead to malnutrition, compromised growth, and developmental shortfalls, perpetuating cycles of poverty and poor health.

South Asia continues to bear a disproportionately high burden of diarrheal disease. In India, approximately 9% of children under five have diarrhea (Das et al., 2024). Studies from India, Bangladesh, and Ethiopia identify maternal education, family income, place of residence, and hygiene practices as major determinants of childhood diarrhea (Paul, 2020). Children of uneducated or poorly nourished mothers, those in low-income families, and those residing in rural or substandard housing are particularly at risk (Hassan et al., 2017).

In Pakistan, diarrheal diseases remain a major public health problem and one of the foremost causes of under-five morbidity and hospital visits (Jabeen et al., 2023). Prevalence is higher in rural districts owing to poverty and limited access to healthcare and sanitation (Qamar et al., 2022). Hospital-based studies identify children of working mothers, kachha (mud-brick) housing, and low-income households as high-risk groups (Aziz et al., 2025). In Punjab, district hospitals manage high volumes of pediatric diarrhea, yet local evidence on socio-demographic and economic drivers remains limited (Khan and Azhar, 2024).

The present study was therefore conducted to determine the association of socio-demographic and economic factors with acute diarrhea among children under five years attending DHQ Hospital, Sheikhupura, with the aim of contributing evidence to inform targeted public health strategies and strengthen diarrheal disease control efforts in Pakistan.

2. MATERIALS AND METHODS

2.1 Study design and setting

This case-control study was conducted at DHQ Hospital, Sheikhupura, Punjab, over six months following approval by the Advanced Studies and Research Board (ASRB) of the University of Health Sciences (UHS), Lahore (IRB No: UHS/DPS/24.1239). Ethical approval was additionally granted by the Medical Superintendent of DHQ Hospital, Sheikhupura. Written informed consent (or thumb impression for illiterate caregivers) was obtained from all participants before enrolment. Confidentiality and voluntary participation were ensured throughout.

2.2 Study population and sample

Cases were children under five years presenting to the Emergency or Outpatient Department (OPD) with acute diarrhea. Controls were children without diarrhea attending the Immunization Centre for routine vaccination, with no history of diarrhea in the preceding 14 days. Sample size was calculated at 180 participants per group based on a 95% confidence level, 90% power, and anticipated exposure proportions of 48% among controls and 58.8% among cases. After accounting for a 10% non-response rate, the final sample comprised 200 cases and 200 controls (total $n = 400$), recruited in a 1:1 ratio using consecutive non-probability sampling. Exclusion criteria included caregiver refusal to consent, critically ill children requiring immediate resuscitation, children with comorbidities, and those with severe acute malnutrition.

2.3 Study variables

The dependent variable was the occurrence of acute diarrhea. Independent variables comprised socio-demographic factors (child sex, child age, maternal age, place of residence, maternal education, maternal occupation) and economic factors (monthly household income, type of house, house ownership, number of rooms, household size, sleeping density, type of latrine, shared toilet facility).

2.4 Data collection instrument

Data were collected using an adopted and pre-validated questionnaire translated into Urdu, with a content validity index (CVI) of 0.96 assessed by five subject-matter experts. The tool comprised two sections: Part I (seven items on socio-demographic characteristics) and Part II (eight items on economic factors).

2.5 Statistical analysis

Descriptive statistics were computed: means and standard deviations for continuous variables, and frequencies with percentages for categorical variables. Associations between independent variables and diarrhea occurrence were tested using the chi-square test. Results are reported as odds ratios (OR) with 95% confidence intervals (CI). A p -value ≤ 0.05 was considered statistically significant.

3. RESULTS

3.1 Sex distribution

Of 200 cases, 118 (59.0%) were male and 82 (41.0%) were female; among 200 controls, 116 (58.0%) were female and 84 (42.0%) were male. Male children predominated among cases and female children among controls (Figure 1).

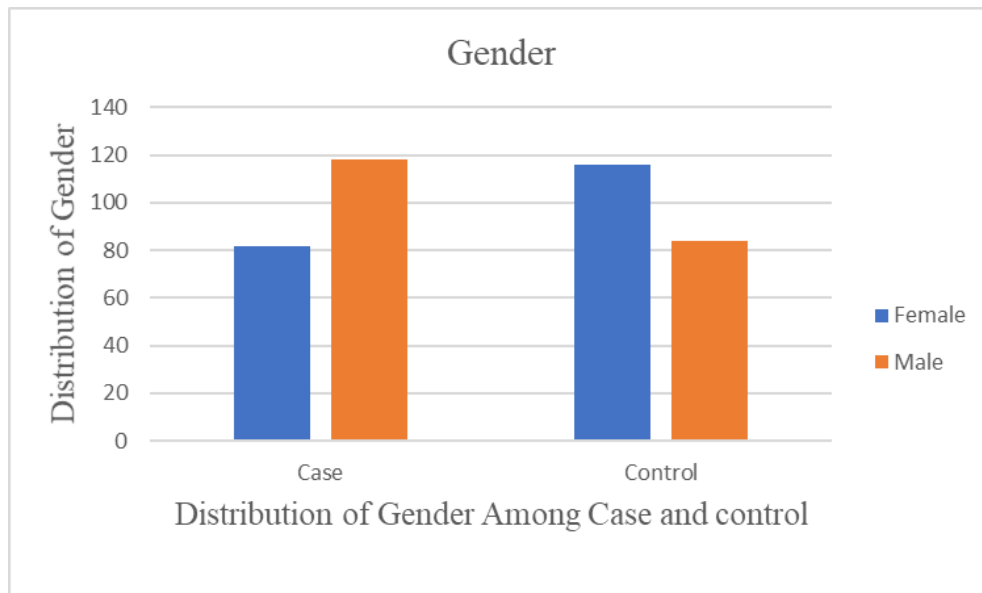


Figure 1. Distribution of sex among case and control groups.

3.2 Age distribution

Among cases, 140 (70.0%) were aged 0–29 months and 60 (30.0%) were aged 30–59 months. Among controls, 161 (80.5%) were aged 0–29 months and 39 (19.5%) were aged 30–59 months (Figure 2).

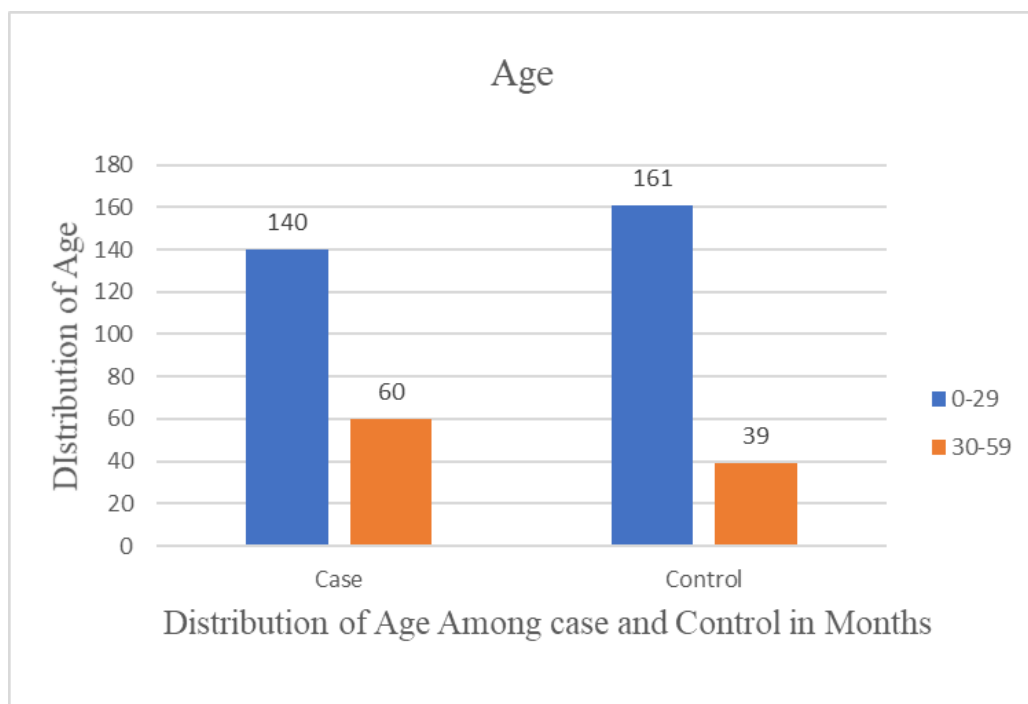


Figure 2. Distribution of age (months) among case and control groups.

3.3 Socio-demographic and economic characteristics

Table 1 summaries participant characteristics across both groups ($n = 400$). The majority of mothers were aged ≤ 30 years (70.8%). More than half of households (58.5%) had one child under five. Residence was nearly evenly split between rural (49.5%) and urban (50.5%) areas. Most mothers had formal education (72.8%) and were housewives (76.0%). Slightly more than half of families (54.8%) reported monthly household income below PKR 25,000. Most lived in pakka housing (86.5%) and owned their home (74.5%). Larger households (≥ 5 members) accounted for 66.8%. Flush latrines were used by 55.0% and most (72.0%) did not share toilet facilities.

Table 1. Socio-demographic and economic characteristics of study participants ($n = 400$)

Variable	Category	Frequency (n)	Percentage (%)
Age of mother (years)	≤ 30	283	70.8
	> 30	117	29.3
No. of children under 5	1	234	58.5
	2	155	38.8
	≥ 3	11	2.8
Place of residence	Rural	198	49.5
	Urban	202	50.5
Maternal education	Non-formal	109	27.3
	Formal	291	72.8
Maternal occupation	Employed	96	24.0
	Housewife	304	76.0
Monthly income (PKR)	$< 25,000$	219	54.8
	$\geq 25,000$	181	45.3
Type of house	Pakka	346	86.5
	Kachha	54	13.5
House ownership	Own	298	74.5
	Rent	102	25.5
Number of rooms	< 2	189	47.3
	≥ 2	211	52.8

Household size	<5 members	133	33.3
	≥5 members	267	66.8
Persons per room	2	20	5.0
	3	179	44.8
	4	102	25.5
	>4	99	24.8
Type of latrine	Flush latrine	220	55.0
	Pit latrine	180	45.0
Shared toilet facility	No	288	72.0
	Yes	112	28.0

3.4 Association of socio-demographic and economic factors with acute diarrhea

Table 2 presents results of the chi-square analysis. Male children were nearly twice as likely to be affected as females (OR = 1.99, 95% CI: 1.34–2.92, $p < 0.001$). Children aged 30–59 months were less likely to have diarrhea than those aged 0–29 months (OR = 0.57, 95% CI: 0.36–0.90, $p = 0.02$). Maternal age ≤ 30 years increased risk (OR = 1.65, 95% CI: 1.10–2.47, $p = 0.015$). Rural children were more frequently affected than urban counterparts (OR = 1.69, 95% CI: 1.14–2.51, $p = 0.01$). Maternal education showed a strong effect: children of mothers without formal schooling were over five times more likely to have diarrhea (OR = 5.42, 95% CI: 3.25–9.03, $p < 0.001$). Household income was the strongest predictor: children from low-income households (<PKR 25,000/month) were approximately twelve times more likely to develop diarrhea (OR = 12.0, 95% CI: 7.46–19.33, $p < 0.001$). Sanitation and housing associations showed unexpected directions and warrant cautious interpretation.

Table 2. Socio-demographic and economic predictors of acute diarrhea in children under five years

Variable / Category	Case n (%)	Control n (%)	p-value	OR	95% CI
Sex of child					
Male	118 (59.0)	84 (42.0)	< 0.001	1.99	1.34–2.92
Female (ref)	82 (41.0)	116 (58.0)			
Age of child					
0–29 months (ref)	140 (70.0)	161 (80.5)	0.02	0.57	0.36–0.90
30–59 months	60 (30.0)	39 (19.5)			
Maternal age					
≤30 years	131 (65.5)	107 (53.5)	0.015	1.65	1.10–2.47

>30 years (ref)	69 (34.5)	93 (46.5)			
Place of residence					
Rural	112 (56.0)	86 (43.0)	0.01	1.69	1.14–2.51
Urban (ref)	88 (44.0)	114 (57.0)			
Maternal education					
Non-formal	85 (42.5)	24 (12.0)	< 0.001	5.42	3.25–9.03
Formal (ref)	115 (57.5)	176 (88.0)			
Maternal occupation					
Employed	59 (29.5)	37 (18.5)	< 0.001	1.80	1.15–2.94
Housewife (ref)	141 (70.5)	163 (81.5)			
Monthly income (PKR)					
<25,000	164 (82.0)	55 (27.5)	< 0.001	12.0	7.46–19.33
≥25,000 (ref)	36 (18.0)	145 (72.5)			
Type of latrine					
Flush (ref)	98 (49.0)	122 (61.0)	0.02	0.61	0.41–0.91
Pit latrine	102 (51.0)	78 (39.0)			
Type of house					
Pakka (ref)	163 (81.5)	183 (91.5)	< 0.001	0.41	0.22–0.75
Kachha	37 (18.5)	17 (8.5)			

OR: odds ratio; CI: confidence interval; ref: reference category; PKR: Pakistani rupees.

4. DISCUSSION

The current study investigated socio-demographic and economic factors associated with acute diarrhea in children under five years attending DHQ Hospital, Sheikhpura. Several significant predictors were identified, including child sex and age, maternal characteristics, household income, place of residence, and living conditions. Most findings were consistent with regional and international evidence; however, associations involving sanitation and housing showed unexpected directions requiring cautious interpretation.

The odds of diarrhea in male children were nearly twice those in females (OR = 1.99), consistent with trends reported in Bangladesh and India (Sarker et al., 2016). Proposed explanations include biological predisposition and greater environmental exposure among boys (Zazara and Arck, 2019; Ferguson et al., 2017). These findings underscore the need to consider sex-based differences when designing preventive programmes.

Younger children (0–29 months) were more vulnerable than those aged 30–59 months, consistent with studies from South Asia and Africa documenting elevated susceptibility in infants and toddlers due to immature immunity and risks associated with complementary feeding (Ahmed et al., 2008; Lutter et al., 2021). Some studies, however, report the reverse, indicating that age-related susceptibility is context-dependent (Messelu and Trueha, 2016; Sahiledengle et al., 2021).

Younger maternal age (≤ 30 years) significantly increased the probability of diarrhea in offspring (OR = 1.65), consistent with prior work linking younger motherhood with poorer child health outcomes owing to limited parenting experience and reduced health information access (Baru et al., 2010; Saaka, 2020).

Maternal education was among the strongest predictors. Children of mothers without formal schooling were over five times more likely to have diarrhea (OR = 5.42), consistent with evidence from Nigeria, Ethiopia, and India showing that maternal education improves hygiene practices, feeding behaviours, and healthcare-seeking (Desmennu et al., 2017; Yilgwan and Okolo, 2012; Nizame et al., 2013).

Household income was the strongest single predictor (OR = 12.0). Poverty restricts access to safe water, sanitation, and healthcare, increasing pathogen exposure and delaying treatment (Brown et al., 2023; Adams et al., 2021). Maternal employment was also associated with increased risk (OR = 1.80), possibly because working mothers rely on caregivers who may not observe optimal hygiene and feeding practices (Caruso et al., 2010). Rural children were significantly more likely to have diarrhea (OR = 1.69), a pattern attributable to inadequate sanitation, unsafe water sources, and limited healthcare access (Alebel et al., 2018; Andrés et al., 2021).

Associations between sanitation/housing variables and diarrhea showed unexpected directions: pit latrine use and kachha housing were associated with lower odds compared with flush latrines and pakka housing, respectively. These findings contradict most published evidence (Kleinau et al., 2004; Yaya et al., 2018; Alemayehu et al., 2021) and may reflect reference category coding artefacts, contextual differences in urban sanitation infrastructure, or unmeasured confounding. These associations must be interpreted with caution and warrant further investigation.

4.1 Public health implications

Diarrheal morbidity among under-five children arises from a constellation of social, economic, and environmental disadvantages. Addressing this burden requires multi-sectoral action: promoting female education, alleviating poverty, improving rural sanitation and safe water access, and strengthening community health programmes targeting young and working mothers.

4.2 Strengths and limitations

The study's strengths include a relatively large sample, the case-control design enabling simultaneous evaluation of multiple predictors, and use of a validated, context-appropriate Urdu instrument. Limitations include the hospital-based setting, which may not reflect community patterns; potential recall bias; and possible unmeasured confounding, particularly for variables showing unexpected directional associations.

5. CONCLUSION

Acute diarrhea among children under five in Sheikhpura is strongly influenced by male sex, younger child age, low maternal education, poverty, and rural residence. Household income and maternal education were the strongest determinants. Interventions to reduce the childhood diarrhea burden in Pakistan must integrate maternal education, poverty alleviation, and improvements in rural sanitation infrastructure.

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Highlights

- Male sex doubles the odds of acute diarrhea in under-five children.
- Non-formal maternal education increases diarrhea risk more than fivefold.
- Household income $< 25,000$ PKR is the strongest single predictor (OR = 12.0).

- Rural residence independently elevates diarrhea risk in this cohort.
- Multi-sectoral interventions targeting poverty, education, and sanitation are needed.

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Declaration of Competing Interests:

The authors declare no conflicts of interest.

Availability of Data:

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Declaration of Generative AI and AI-Assisted Technologies in the Manuscript Preparation Process

The authors did not use generative AI or AI-assisted technologies in the preparation of this manuscript.

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