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RESEARCH ARTICLE

Is Malnutrition a Determinant of Scabies among Preschool Children? Evidence from East Badiwacho District, Hadiya Zone, Central Ethiopia

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Abstract

Background: Undernourished children living in crowded housing, particularly in tropical countries, are at a higher risk of suffering from scabies. Understanding the relationship between these serious conditions in preschool children can aid in developing effective and cost-efficient strategies to prevent malnutrition in regions where scabies is prevalent. This study aimed to determine the relationship between malnutrition and scabies among preschool children in the East Badawacho district of the Hadiya Zone, Central Ethiopia.

Methods: A health institution-based unmatched case-control study design was employed, involving 348 participants who were compared based on their scabies status. Preschool children with scabies were contrasted with those without in East Badawacho District, Central Ethiopia. The children's nutritional status was assessed anthropometrically and analyzed using the World Health Organization Anthro software. Data were entered into EPI-info version 11 and subsequently exported to SPSS version 26 for analysis. Bivariate and multivariable analyses identified determinants of scabies, with statistical significance set at a P-value of less than 0.05.

Results: Significant independent predictors associated with scabies infestation included severe wasting (AOR = 2.4, 95% CI: 1.32-5.47), usage of less than 20 liters of water daily by mothers of preschool children (AOR = 2.5, 95% CI: 1.02-6.27), sharing clothes with someone infected with scabies (AOR = 6.7, 95% CI: 2.98-15.08), and washing with water only (AOR = 2.4, 95% CI: 1.37-6.77).

Conclusion: Preschool children who were severely wasted, utilized less than 20 liters of water for daily activities, shared clothing with scabies-infected peers, and washed only with water were significantly associated with scabies transmission. Therefore, scabies control programs should integrate nutritional interventions to effectively address this issue.

Keywords: Malnutrition, Scabies, Pre-school children, Central Ethiopia

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1 Introduction

Scabies is a parasitic infestation caused by the mite Sarcoptes scabiei var. hominis, which burrows into the stratum corneum of the skin, laying eggs and causing intense itching [1]. The adult mites are microscopic, measuring 0.3–0.4 mm. Their lifecycle includes egg deposition, molting, and mating, with re-infestation occurring primarily through direct skin-to-skin contact [1]. Scabies is recognized as one of the most common neglected tropical diseases (NTDs) affecting vulnerable populations in low-resource settings [1].

The transmission of scabies is primarily through prolonged skin-to-skin contact and is facilitated by overcrowding, poor hygiene, and shared clothing and bedding [2]. Clinical manifestations include serpiginous burrows, papules, and nodules, often found in inter-digital spaces, wrists, elbows, and genital areas [3, 4, 5]. Diagnosis is typically clinical, although a detailed examination of infected skin samples with a direct microscope can confirm the presence of mites, eggs, or fecal pellets [6].

Scabies affects at least 200 million people worldwide at any given time, with an estimated 5-50% of children in low-resource communities being affected. Recent studies indicate that prevalence rates range between 0.3% and 46% [7, 8]. In Sub-Saharan Africa, prevalence can vary significantly, with rates reported as high as 33.7% [9].

In 2020, it was estimated that 149 million children under five were stunted, and 45 million were wasted. Undernutrition accounts for approximately 45% of deaths among children under five [10]. In Sub-Saharan Africa, a UNICEF report states that 9.0% of preschool-aged children experience acute malnutrition or wasting, while 38.0% experience chronic malnutrition or stunting [11].

Malnutrition is a significant public health problem in many developing countries, driven by various social and economic factors, including lack of education, inadequate healthcare resources, cultural attitudes, acute food insecurity, recent illness, and improper childcare or feeding practices. Nearly 30.0% of the population in developing regions suffers from one or more forms of malnutrition [12]. Undernourished children have compromised immune systems, face long-term developmental challenges, and are 5 to 20 times more likely to die than well-nourished children [13].

Despite its global burden, scabies is often underprioritized in public health strategies. Nigeria has reported prevalence rates ranging from 4.7% to 65% [14]. In Ethiopia, scabies is widespread, particularly during natural or man-made disasters such as flooding, drought, and conflict-related displacement, exacerbated by lack of access to clean water and sanitation and overcrowded living conditions [15]. Frequent outbreaks have been noted in drought-affected areas of the Amhara region, with prevalence rates as high as 19% [16]. A public health emergency surveillance report has indicated that scabies is emerging as a public health concern, increasingly affecting populations in geographic areas afflicted by drought and malnutrition [17].

In Ethiopia, limited access to clean water and sanitation has further facilitated the spread of scabies, especially among children in institutional settings such as schools [18]. Scabies significantly affects quality of life, leading to sleep disturbances, school absenteeism, and psychosocial distress [19, 20]. It also imposes economic burdens due to treatment costs and lost productivity [21]. Although the WHO has supported mass drug administration (MDA) campaigns using Ivermectin, localized data on prevalence and risk factors remain scarce [22, 23].

As poor nutritional status is often associated with scabies infestation in preschool children, no study to date has established the role of nutritional status in developing scabies. Therefore, this study aims to establish the association between nutritional status and the incidence of scabies in preschool children living in the East Badawacho District of Hadiya Zone, Central Ethiopia, particularly if poor nutritional status—represented by stunting, wasting, and underweight—proves to be a crucial factor.

2 Methods and Materials

2.1 Study are and period

The study was conducted in the Hadiya Zone, specifically in the East Badawacho District, which is located approximately 345 km south of the capital, Addis Ababa. The total number of children aged 24 to 59 months in the study area is estimated to be 18,123. The district is home to 27 community health posts. The research was carried out from January to February 30, 2024.

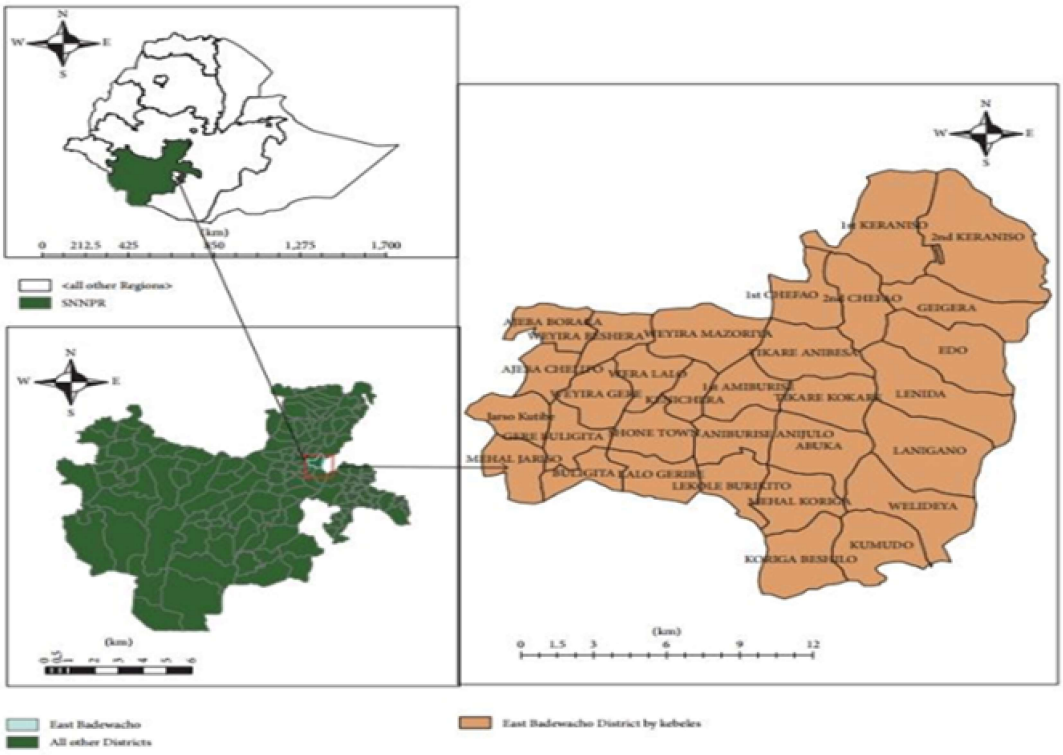

Figure 1 Figure 1: Administrative map of the study area, East Badawacho district, Central Ethiopia, 2024

2.2 Study design

Health institution-based unmatched case-control study was employed.

2.3 Source population

All pre-school children in East Badawacho district

2.4 Study population

Cases: selected pre-school children of 24-59months of age with scabies who get treatment in a community health posts in East Badawcho district.

Controls: selected pre-school children of 24-59 months of age who have no scabies but treated in a community health posts for other causes in East Badawcho district.

2.5 Eligibility criteria

Inclusion criteria

Cases: All preschool children aged 24 to 59 months with clinically confirmed scabies who visited a community health post for treatment, accompanied by their mother or caregiver, in the East Badawacho District were included in the study.

Controls: All preschool children aged 24 to 59 months who did not exhibit signs or symptoms of scabies but visited a community health post for treatment of other medical conditions, accompanied by their mother or caregiver, in the East Badawacho District were included in the study.

Exclusion Criteria:

Mothers or caregivers who were not permanent residents of the study area were excluded from both the case and control groups.

Preschool children who were ill and seeking treatment for other medical conditions in a community health post in East Badawacho District were excluded from both the case and control groups.

2.6 Sample size determination

The sample size was calculated using Info™ version 7 StatCalc, based on the following assumptions: a desired power of 80% to detect a group difference at a confidence level of 5%, and a control-to-case ratio of 1:2. It was assumed that the prevalence of bed sharing with scabies-infected children is 25.3% among controls and 39.8% among cases. The calculated sample size was 323. To account for participant attrition and non-response, an adjustment of 8% was made, resulting in a final sample size of 348 (116 cases and 232 controls).

2.7 Sampling procedure

Eight community health posts were selected using a simple random sampling technique based on the health institution profile from the East Badawacho District Health Office. Data on preschool children aged 24 to 59 months were obtained from the registration logbooks of these community health posts for the proportional allocation of the sample size to each location. When clinically confirmed scabies cases that met the inclusion criteria were identified, two controls were selected for each case, and the parents or caregivers were interviewed. Additionally, anthropometric measurements of preschool children were conducted. All cases and controls were consecutively identified from each community health post until the required sample size was achieved (see Figure 2).

2.8 Data collection procedure

A total of nine health officers and one supervisor were recruited as data collectors. They received two days of training from the principal investigator on the study's objectives, data collection tools, anthropometric measurements, interviewing procedures, and participant recruitment. The data collectors were fluent in the Hadiyisa language.

The children's weight was measured using a digital weighing scale, while their height was assessed using a column-mounted height stadiometer. Measurements were taken with the children barefoot and wearing minimal clothing. Weight and height were rounded to the nearest 0.1 kg and 0.1 cm, respectively. The weighing scales were regularly calibrated. Additionally, a local calendar was created to improve accuracy in estimating the ages of children.

2.9 Operational definitions

Cases: defined as pre-school children with at least three indications of scabies infestation, namely papules, vesicles, and linear burrows with concomitant pruritus and scratch marks in the axilla, belt line, legs, feet, and buttock in the selected health posts [11].

Controls: defined as a preschool child who does not exhibit any sign and symptoms of scabies infestation.

Pre-school children: The children whose age is between 24 and 59 months (14,16).

Overcrowding: More than four persons living in one room is considered a high risk of disease transmission [1].

Malnourished: A preschooler who exhibits stunting, wasting, or underweight is considered to be malnourished. The malnutrition indicators analyzed in this study are defined below-

Stunting : HAZ< -2 Z-score based on WHO reference group [11].

Under-weight : WAZ < -2 Z-score, based on WHO reference group [11].

Wasting: was defined as WHZ < -2 Z-score [11].

Sever wasting was defined as WHZ < -3 Z-score [11].

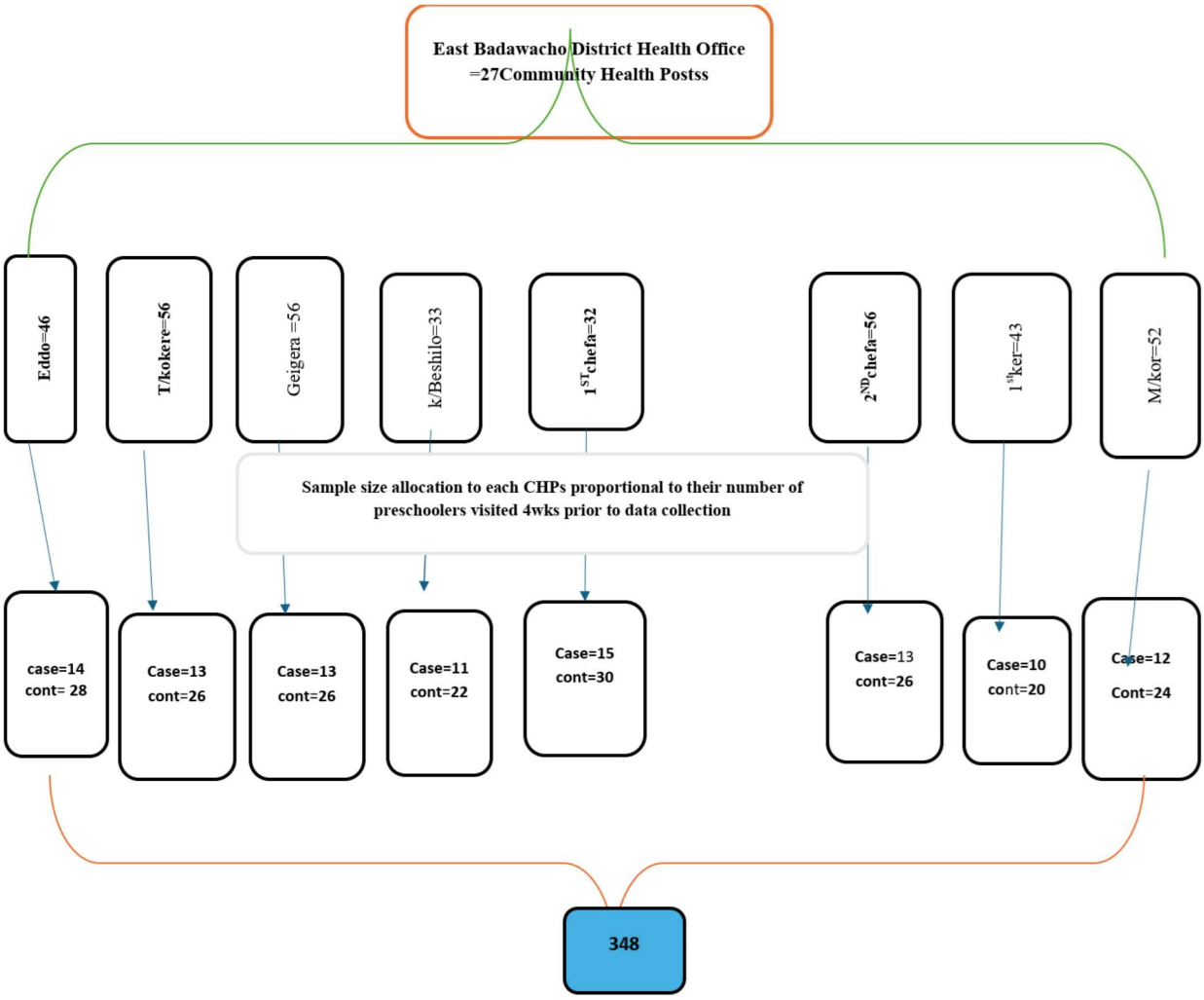

Figure 2 Schematic presentation of sampling technique of preschool children in East Badawacho District, Hadiyya Zone, Central Ethiopia, 2024

2.10 Data processing and analysis

Collected data from a structured questionnaire were checked, coded, and entered into EpiData version 3.1 before being exported to SPSS version 25 for analysis. The anthropometric data were imported into the WHO Anthro statistical program to analyze nutritional indicators. Severe stunting, underweight, and wasting were evaluated when Height-for-Age Z-scores (HAZ), Weight-for-Age Z-scores (WAZ), and Weight-for-Height Z-scores (WHZ) were less than -3. Malnutrition was defined as the presence of any of the three indices below -2 Z-scores.

A descriptive analysis of the socio-demographic characteristics of the respondents was conducted using tables to assess participant attributes and determine the prevalence of malnutrition among both cases and controls.

Bivariate logistic regression analysis was performed to explore the crude associations between various predictor variables and scabies infestation. All independent variables associated with scabies infestation in the bivariate analysis with a P-value < 0.25 were considered candidates for multivariable logistic analysis.

Multivariable logistic regression analyses were conducted for those variables with P-values $<$ 0.25 in the bivariate analysis to account for potential confounders and identify factors associated with scabies. The absence of multicollinearity among the explanatory variables was assessed using the variance inflation factor (VIF = 2.15–2.84) and tolerance (0.5).

Adjusted odds ratios along with 95% confidence intervals (CIs) were calculated to measure the strength of the associations. A P-value < 0.05 was used to determine statistically significant associations between independent and dependent variables.

3 RESULT

3.1 Demographic and Socio- economic characteristics of the study participants

This study interviewed 349 child caretakers or

Table 1 Demographic and Socio-economic characteristics of the caretakers by study group in East Badawacho woreda, 2024

Socio demographic characteristics	Caretakers of Cases (%) n=116	Controls (%) n=232	Total n(%)
Age of mother			
15-24year	16(13.8)	16(6.9)	32(9.2)
25-34year	37(30.9)	107(45.9)	144(41.3)
35-44year	54(46.6)	100(42.9)	154(44.1)
≥45year	9(7.8)	10(4.3)	19(5.4)
Residence			
Rural	113(97.4)	210(90.1)	323(92.6)
Semi-urban	3(2.6)	23(4.9)	26(7.4)
Marital status of mothers			
Married	107(92.2)	202(86.7)	309(88.5)
Never married (single)	4(3.4)	13(5.6)	17(4.9)
Divorced	3(2.6)	7(3.0)	10(2.9)
Widowed	1(0.9)	7(3.0)	8(2.3)
Separated	1(0.9)	4(1.7)	5(1.4)
Educational status of mother			
Illiterate	95(81.9)	83(35.6)	178(51.0)
Primary (1-8)	14(12.1)	128(54.9)	142(40.7)
Secondary (9-12)	6(5.2)	20(8.6)	26(7.4)
Tertiary	1(0.9)	2(0.09	3(0.9)
Occupational status of mother			
Housewife	88(75.9)	173(74.2)	261(74.8)
Farmer	10(7.8)	32(10.7)	42(9.7)
Government employee	9(7.8)	17(7.3)	26(7.4)
Merchant	9(7.8)	11(3.9)	20(5.2)
Family size			
≤5	13(11.2)	189(81.1)	202(57.9)
>5	103(88.8)	44(18.9)	147(42.1)
Roof of the house made			
Thatched	83(76.6)	117(50.2)	200(57.3)
Corrugated iron	33(28.4)	116(49.8)	149(42.7)
Household average monthly income			
≤1500ETB(≤26.29USD)	82(70.7)	155(66.5)	237(67.9)
>1500ETB(>26.29USD)	34(29.3)	78(33.5)	112(32.1)

mothers, achieving a response rate of 100% for both cases and controls. The mean age of the children was 40 ± 10.1 months for both groups. Nearly half of the respondents were aged between 35 and 44 years, with 54 (46.6%) cases and 100 (42.9%) controls falling within this age range. Many study participants, 323 (92.6%), resided in rural areas, while 26 (7.4%) lived in semi-urban areas in both groups.

Over seventy percent of respondents identified as Protestant, with the remainder being Orthodox Christians and others. Additionally, 309 (88.5%) of the mothers in both groups were married. More than half of the mothers had received a primary education, while 37.8% were illiterate across both categories.

The primary occupation of mothers was homemakers, comprising three-quarters of the cases (173; 74.2%) and 88 (74.9%) of the controls. In both groups, most husbands (almost 70%) were farmers, while the lowest percentage (3.2%, or 119 individuals) were merchants.

In terms of family size, 44 (18.9%) of the controls and 103 (88.8%) of the cases belonged to families with more than five members. The number of preschool children in households with more than 2 children included 45 (38.8%) cases and 109 (46.8%) controls. Thatched roofs were observed in 76.6% of cases and 50.2% of control homes (see Table 1).

3.2 Clinical presentation of the child (for cases only)

Of the mothers of children with scabies, 96 (82.8%) reported that the itching was worse at night. Most cases (100 or 86.2%) still exhibited a rash. More than half of the cases (64, 55.2%) experienced itching that lasted more than eight days. The hands were the most affected body parts, reported in 64.7% of cases (see Table 2).

Table 2 Clinical presentation of the child (for cases only) in East Badawacho woreda, 2024

Explanatory Variables	Categories	Cases(%) n=116
Time itching intense	Day time	20(17.2)
	Night time	96(82.8)
Duration of itching	<8days	52(44.8)
	≥8days	64(55.2)
Still have rash	Yes	100(86.2)
	No	16(13.8)
Mostly affected body part	The hand	75(64.7)
	Feet	19(16.4)
	Elbow	19(16.4)
	Axillaries	3(1.7)

3.3 Childs characteristics and Nutritional Status

Out of the 348 preschoolers enrolled in the study, more than half (58.4%) of the cases and half (51.5%) of the controls were male. The age of the children varied from 34 to 43 months, with 49 (42.2%) cases and 75 (32.5%) controls falling within this age range. The age group of 54–59 months had the lowest percentages of cases and controls, at 9.5% and 14.2%, respectively.

Stunting: More than half of the children, 209 (60%), were stunted, with 106 (32%) severely stunted. The prevalence of stunting was 76 (65.5%) among cases and 133 (57.1%) among controls. Among them, 29 (27%) cases and 78 (24.3%) controls were severely stunted.

Underweight: A total of 213 (61%) of children under five were underweight, with 105 (31.1%) classified as severely underweight. More than half, 71 (61.2%) of the preschoolers in the cases

and 142 (60.9%) of the controls, were underweight. By these metrics, 36 (31%) of the cases and 69 (29.6%) of the controls were severely underweight.

Wasting: Overall, 277 (79.4%) of children under five were wasted, with 124 (35.5%) severely wasted. Among these, 86 (74.1%) cases and 191 (81.9%) controls were classified as wasted. According to Weight-for-Height Z-scores (WHZ), 48 (40.4%) cases and 76 (32.6%) controls were severely wasted (see Table 3).

Table 3 Child's characteristics and Nutritional Status in East Badawacho District, 2024

Explanatory Variables	Categories	Cases (%) n=116	Controls (%) n=232	Total, n(%)
Age of the child	24-33months	19(16.4)	74(31.9)	93(26.7)
	34-43months	49(42.2)	75(32.5)	124(35.6)
	44-53months	37(31.9%)	50(21.6)	87(25.0)
	54-59months	11(9.5)	33(14.2)	44(12.0)
Sex of the child	Male	47(40.5)	133(57.1)	180(51.6)
	Female	69(59.5)	100(42.9)	169(48.4)
Stunting	WAZ <-3	39(33.6)	67(29.8)	106(32)
	-3 ≤ HAZ <-2	37(31.9)	66(28.3)	103(23)
	HAZ ≥ -2	40(34.5)	100(42.9)	140(45)
Underweight	WAZ <-3	36(31.0)	69 (29.6)	105(30.1)
	-3 ≤ WAZ <-2	35(30.2)	73(31.3)	108(30.9)
	WAZ ≥ -2	48(41.4)	91(39.1)	139(39.8)
Wasting	WHZ <- 3	48(40.4)	76(32.6)	124(35.5)
	-3 ≤ WHZ <-2	38(32.8)	115(49.4)	153(43.8)
	WHZ ≥ -2	30(25.9)	158(67.8)	188(53.9)

3.4 Bivariable and multivariable logistic regression analysis

In the bivariable logistic analysis, several factors were found to be significantly associated with scabies infestation: severe malnutrition, male sex of the child, rural residence, family size of five or more members, thatched roofs, daily water consumption of less than 20 liters, sharing clothes with someone infected with scabies, the distance of the healthcare facility from home, sleeping with an infested individual, using only water as a detergent, and wasting.

Wasted children were more likely to contract scabies, with severely wasted children (WHZ < -3) having a threefold higher chance of scabies infestation compared to non-wasted children (COR=2.5, 95% CI:1.41, 5.86). Male children had 2.9 times higher odds of scabies infestation (COR=2.9, 95% CI:0.85, 4.75). Children from rural areas were 4.1 times more likely to be infected compared to semi-urban children (COR=4.13, 95% CI:1.21, 14.04).

An increased family size correlated with a higher likelihood of developing scabies; families with five or more members were 14.5 times more likely to have scabies compared to families with fewer members (COR = 14.48, 95% CI: 8.22, 25.51). Living in a house with a thatched roof was also associated with scabies, as children in thatched roof homes were 2.5 times more likely to be infested than those living in corrugated iron houses (COR = 2.5, 95% CI: 1.55, 4.02).

Low daily water consumption was linked to scabies infestation; households using less than 20 liters of water for daily activities were 3.7 times more likely to be infested than those using more

(COR = 3.72, 95% CI: 1.92, 7.20). Furthermore, children who shared clothes with an infected individual were 6.4 times more likely to develop scabies (COR = 6.41, 95% CI: 1.39, 3.53). Children who slept with a scabies-infested person were 2.2 times more likely to contract scabies compared to those who did not (COR = 2.23, 95% CI: 1.39, 3.53). Lastly, children who washed their bodies with only water were 3.4 times more likely to be infested with scabies than those who used soap and water (COR = 3.4, 95% CI: 2.14, 5.49).

In the multivariable analysis, after adjusting for potential confounding factors, the results of the logistic regression analysis indicated that severely wasting, daily water consumption of less than 20 liters, sharing clothes with a scabies-infected person, and using only water as a detergent were significant determinants of scabies.

Severely wasted children (WHZ < -3) had a 2.4 times higher risk of scabies infestation compared to non-wasted children (adjusted OR=2.4, 95% CI:1.32, 5.47).

Daily water consumption of less than 20 liters was identified as an independent predictor of scabies. Children from households using less than 20 liters of water per day were 2.5 times more likely to be infected with scabies than those from households using more than 20 liters daily (AOR = 2.5; 95% CI: 1.02, 6.27).

Table 4 Shows Bivariable and Multivariable logistic regression analysis of determinants associated with scabies among pre-school children in East Badawacho district, 2024

Variables	Categories	Cases (%) n=116	Controls(%) n=232	COR (95% CI)	AOR (95% CI)
Residence	Semi-urban	113(97.4)	210(90.1)	1	1
	Rural	3(2.6)	23(4.9)	4.13(1.21,14.04)	5.1(0.82,31.86)
Family size	≥ 5	20(17.2)	175(75.1)	14.48(8.22,25.51)	2.3(0.85,4.75)
	<5	96(82.8)	58(24.9)	1	1
Sex of the child	Male	36(31)	133(57.1)	2.9(0.85,4.75)	3.4(0.55,7.40)
	Female	80(69)	100(42.9)	1	1
Roof of the house made	Thatched	83(76.6)	117(50.2)	2.49(1.55,4.02)	0.48(0.21,1.07)
	Corrugated iron	33(28.4)	116(49.8)	1	1
Amount of water for daily basis	≥20litres	12(10.3)	70(30.0)	1	1
	<20litres	104(89.7)	163(70.0)	3.72(1.92,7.20)	2.5(1.02,6.27)*
Child shared clothes	No	90(77.6)	82(35.2)	1	1
	Yes	26(22.4)	151(64.8)	6.37(3.82,10.64)	6.7(2.98,15.08)***
Child sleeping with scabies infested person	No	78(67.2)	112(48.1)	1	1
	Yes	38(32.8)	121(51.9)	2.23(1.39,3.53)	1.1(0.49,2.31)
Having animal inside the house	Yes	92(79.3)	190(81.5)	3(1.55,4.02)	0.48(0.51,4.75)
	No	24(20.7)	43(18.5)	1	1
Detergents used	Water with Soap	61(52.6)	57(24.5)	1	1
	Water only	55(47.4)	176(75.5)	3.43(2.14,5.49)	3.0(1.37,6.77)**
Stunting	Severe stunting	39(33.6)	67(29.8)	2.0(1.41,5.86)	2.0(1.32,5.47)
	Moderate stunting	37(31.9)	66(28.3)	2.1(0.14,0.19)	3.0(0.37,6.77)
	No stunting	40(34.5)	100(42.9)	1	1
Wasting	Severe wasting	51(44.0%)	52(22.3%)	2.5(1.41,5.86)	2.4(1.32,5.47)**
	Moderate wasting	54(46.6)	41(17.6)	2.1(0.14,0.69)	3.0(0.37,6.77)
	No wasting	11(9.5)	140(60.1)	1	1
Underweight	Severe under weight	36(31.0)	69 (29.6)	1.6.(1.41,5.86)	2.4(1.32,5.47)
	Moderate underweight	35(30.2)	73(31.3)	2.0(0.14,0.69)	3.0(0.37,6.77)
	No underweight	48(41.4)	91(39.1)	1	1

The odds of having a scabies infestation were 6.7 times higher among children who shared clothes with someone infected than among those who did not (AOR = 6.7, 95% CI: 2.98, 15.08). Additionally, children who washed their bodies with only water were 3.4 times more likely to contract scabies than those who used soap and water (AOR = 3.4, 95% CI: 1.37, 6.77).

Other factors, including residence, maternal education status, maternal occupation, sex of the child, husband's occupation, family size, household average monthly income, distance to healthcare facilities, sleeping with scabies patients, frequency of body washing, sharing clothes with other family members, traveling to areas with scabies epidemics, water sources, presence of animals in the household, flooding in the home, stunting, and wasting, were not significantly associated with scabies in the multivariable analysis (see Table 4).

4 Discussion

Scabies is a neglected skin infestation that occurs worldwide, significantly impacting health and quality of life. Its prevalence is particularly high among children in areas of low economic status [6]. Poor nutritional status is often cited as a risk factor for scabies infestation; however, no studies have conclusively proven this link. Therefore, this study aimed to assess the association between nutritional status—represented by stunting, underweight, and wasting—and scabies infestation in children living in the East Badawacho district.

In the current study, nutritional status indicated by severe wasting, along with other determinants such as sharing clothes with scabies-infected individuals, daily water consumption of less than 20 liters, and the use of only water as a detergent, were identified as independent predictors of scabies infestation among cases and controls.

This study compared the prevalence of malnutrition in preschool children between scabies cases and controls to investigate the association between malnutrition and scabies. After adjusting for potential confounders, there was a statistically significant association between severe wasting and scabies infestation in preschool children. Severely wasted children were two times more likely to develop scabies compared to non-wasted preschoolers.

Understanding how malnutrition affects infections in general is crucial for comprehending its specific impact on scabies. It is already known that malnutrition increases susceptibility to infections, while infections can adversely affect nutritional status [10, 11]. The reduction in immunity among malnourished children primarily explains their decreased resistance to infections. In contrast to these findings, a prior cross-sectional study conducted in Indonesia [20] found no significant association between malnutrition and scabies infestation. Discrepancies may arise from differences in sampling techniques, adjustment for confounding variables, or variations in scabies prevalence and nutritional status among study populations. Socio-economic status, geographical variations, healthcare access, and other factors may also influence observed outcomes. In this study, however, stunting and underweight were not found to be associated with scabies infestation in preschool children.

To effectively address scabies infestations among children in Ethiopia, particularly in the study area, it is essential to analyze multiple factors that influence scabies. Consequently, this study aimed to investigate various risk factors associated with scabies infestation.

Our findings revealed that sharing clothes with someone who has had an itchy skin lesion in the past two months is a major risk factor for scabies. This is supported by studies conducted in Ethiopia and Egypt [1, 3, 9]. The increased interaction between individuals and sharing of clothing or bedding may result from limited resources in homes.

The current study demonstrated that children who shared clothes with scabies-infected individuals had higher odds of infestation (AOR = 1.1; 95% CI: 0.49, 2.31). This aligns with findings from studies in Egypt and Pakistan [7]. Sharing clothing facilitates the transmission of

scabies mites, as children sharing clothes with infected persons are more susceptible to severe and repeated infections due to the critical role of contact in disease transmission. Mites can survive on clothing for extended periods unless thoroughly laundered, making it easy for children sharing clothes to contract the disease, even if medication has been administered.

This study also found that washing with only water was associated with an increased risk of scabies infestation. Previous research has indicated that regularly using soap for washing hands and clothes is more effective in preventing scabies than using water alone; this finding is consistent with a study conducted in Dabat, Ethiopia [21]. The use of detergents is essential for eliminating scabies mites, particularly immature ones, which helps reduce the risk of transmission by lowering mite density.

Daily water consumption of less than 20 liters was identified as an independent determinant of scabies. This study found that those who consumed less water were more likely to have scabies. This association may be attributed to insufficient water for basic household tasks, such as cleaning and washing clothes and bodies with soap. Evidence suggests that regular bathing with soap can significantly decrease scabies incidence. Therefore, inadequate domestic and personal hygiene, likely due to low water availability, could explain this finding. This result is consistent with a matching analysis conducted in rural Ethiopia [23].

4.1 Recommendations

Based on these findings, the government is encouraged to prioritize poverty reduction efforts, as poverty is a fundamental factor that exacerbates poor hygiene, limited access to clean water, and malnutrition—all of which contribute to an increased risk of scabies infestation among preschool children.

The East Badawacho District Health Office should pay special attention to severely malnourished children in their prevention and control of scabies. Establishing integrated health services that simultaneously address malnutrition and scabies among preschool children at both community and facility levels is essential.

Health professionals and health extension workers are urged to provide health education and sensitization to mothers and caregivers. This education should focus on reducing the sharing of clothing among children and promoting the use of adequate detergents for washing their bodies, especially in families affected by scabies. Additionally, regular screening programs in health posts and community outreach initiatives should be strengthened for the early identification of children at risk from both burdens.

The community in East Badawacho District is encouraged to focus on improving children's nutritional status through balanced diets and to seek support from health facilities when necessary. Finally, further studies at the community level are recommended to better understand additional factors driving scabies infestation and its impact on the quality of life of affected children.

Limitation

The study findings should be interpreted considering the following limitations. First, case selection relied on registered lists based on case definitions without laboratory confirmation, which may introduce misclassification bias. Secondly, the study population consisted only of individuals identified from community health posts and may not accurately represent the broader community.

Acronyms and abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
DHIS	Demographic Health Information System
EDHS	Ethiopian Demographic Health Survey
HFA	Height for Age
ICCM	Integrated community case management
NTD	Neglected Tropical Dieses
PEM	Protein Energy Malnutrition
SDG	Sustainability Development Goal
SNNPRS	Southern Nations Nationalities and Peoples Regional State
USA	United States of America
WASH	Water Hygiene and Sanitation

WFA	Weight for Age
WFH	Weight for Height
WHO	World Health Organization

Declaration

Ethical consideration

Ethical approval was obtained from the Institutional Review Board (IRB) of Dilla University College of Health Science and Medicine after the purpose and objectives of the study were presented. A support letter was secured from the Department of Reproductive Health and submitted to the East Badawacho District Health Office to conduct the study. Written consent was obtained from each participant, and they were informed that participation was voluntary and that they could withdraw at any time if they chose not to respond to any questions. To maintain confidentiality, information was collected during separate interviews, with identifying data, such as names, excluded.

Consent for publication: Not applicable

Data availability statement

The datasets used in this study can be obtained from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

Authors' contribution

All authors made a significant contribution to the work reported. MM, GN, MB, MMB, EA, and YA, participated in the conception, study design, execution, data acquisition, data analysis and interpretation of the study findings. All authors were involved in drafting, revising, and critically reviewing the article; provided final approval of the version to be published; agreed on the journal to which the article has been submitted; and accepted accountability for all aspects of the work.

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References

1. Engelman D, Steer AC. Control Strategies for Scabies. Trop Med Infect Dis. 2018;3(3).
2. Salavastru CM, Chosidow O, Boffa MJ, Janier M, Tiplica GS. European guideline for the management of scabies. *J Eur Acad Dermatol Venereol.* 2017;31(8):1248-53.
3. Dominguez-Santas M, Roustan-Gullon G, Alfageme-Roldan F. Sonographic findings in scabies. *Journal of Ultrasound.* 2022.
4. Li F-Z, Chen S. Diagnostic Accuracy of Dermoscopy for Scabies. *Korean J Parasito.* 2020;58(6):669-74.
5. Scanni G. Facilitations in the Clinical Diagnosis of Human Scabies through the Use of Ultraviolet Light (UV-Scab Scanning): A Case-Series Study. *Tropical Medicine and Infectious Disease.* 2022;7(12):422.
6. Sunderkötter C, Wohlrab J, Hamm H. Scabies: Epidemiology, Diagnosis, and Treatment. *Dtsch Arztebl Int.* 2021;118(41):695-704.
7. Engelman D, Yoshizumi J, Hay RJ, Osti M, Micali G, Norton S, *et al.* The 2020 International Alliance for the Control of Scabies Consensus Criteria for the Diagnosis of Scabies. *Br J Dermatol.* 2020;183(5):808–20.
8. Ariza L, Walter B, Worth C, Brockmann S, Weber ML, Feldmeier H. Investigation of a scabies outbreak in a kindergarten in Constance, Germany. Vol. 32, European *Journal of Clinical Microbiology and Infectious Diseases.* 2013. p. 373–80.
9. Azene AG, Aragaw AM, Wassie GT. Prevalence and associated factors of scabies in Ethiopia: Systematic review and Meta-analysis. *BMC Infect Dis.* 2020 May 27;20(1).
10. Kaburi BB, Ameme DK, Adu-asumah G, Dadzie D, Tender EK, Addeh SV, *et al.* Outbreak of scabies among preschool. 2019;1–9.
11. Shikur B, Deressa W, Lindtjørn B. Association between malaria and malnutrition among children aged under-five years in Adami Tulu District, south-central Ethiopia: A case-control study.

BMC Public Health [Internet]. 2016;16(1):1–8. Available from: http://dx.doi.org/10.1186/s12889-016-2838-y.

12. Gone T, Lemango F, Eliso E, Yohannes S, Yohannes T. The association between malaria and malnutrition among under-five children in Shashogo District, Southern Ethiopia: A case-control study. *Infect Dis Poverty* [Internet]. 2017;6(1):4–11. Available from: http://dx.doi.org/10.1186/s40249-016-0221-y.

13. Wochebo W, Haji Y, Asnake S. Scabies outbreak investigation and risk factors in Kechabira district, Southern Ethiopia: Unmatched case control study. *BMC Res Notes*. 2019 May 29;12(1).

14. WHO. Drought and Disease Outbreaks in Ethiopia: *World Health Organisation*; 2016 40 [Available from: https://www.afro.who.int/sites/default/files/2017-05/160208-41ethiopia_partner-engagement-1_jan2016_final_ap.pdf.

15. Hay RJ, Johns NE, Williams HC, Bolliger IW, Dellavalle RP, Margolis DJ, *et al.* The global burden of skin disease in 2010: An analysis of the prevalence and impact of skin conditions. *J Invest Dermatol* [Internet]. 2014;134(6):1527–34. Available from: http://dx.doi.org/10.1038/jid.2013.446

16. Azene AG, Aragaw AM, Wassie GT. Prevalence and associated factors of scabies in 2 Ethiopia: systematic review and Meta-analysis. *BMC Infect Dis*. 2020;20(1):380.

17. Kline K, McCarthy JS, Pearson M, Loukas A, Hotez PJ. Neglected Tropical Diseases of Oceania: Review of Their Prevalence, Distribution, and Opportunities for Control. *PLoS Negl Trop Dis*. 2013;7(1):1-9.

18. MoH. Elimination of Neglected Tropical Diseases (NTDs) in Ethiopia: MOH 2020 9 [Availablefrom: https://www.eliminateschisto.org/sites/gsa/files/content/attachments/2020-021018/191019%20Final%20WASH-NTD%20Woreda%20toolkit-%20English.pdf

19. Ejigu K, Haji Y, Toma A, Tadesse BT. Factors associated with scabies outbreaks in primary 12 schools in Ethiopia: a case-control study. *Res Rep Trop Med*. 2019;10:119-27. 13 21.

20. Sara J, Haji Y, Gebretsadik A. Scabies Outbreak Investigation and Risk Factors in East 14 Badewacho District, Southern Ethiopia: Unmatched Case Control Study. *Dermatology Research and Practice*. 2018;2018:7276938

21. Wochebo W, Haji Y, Asnake S. Scabies outbreak investigation and risk factors in Kechabira 17 district, Southern Ethiopia: unmatched case control study. *BMC Res Notes*. 2019;12(1):305.

22. Engelman D, Yoshizumi J, Hay RJ, Osti M, Micali G, Norton S, *et al.* The 2020 International 30 Alliance for the Control of Scabies Consensus Criteria for the Diagnosis of Scabies. *Br J 31 Dermatol*. 2020;183(5):808-20.

23. WHO. Scabies: World Health Organisation; 2020 [Available from: https://www.who.int/news-room/fact-sheets/detail/scabies