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Original Article

Assessment of Socio-Demographic and Economic Characteristics and Nutritional Status of Children in Navakholo Sub-County, Kakamega County, Kenya

Hazel Awuor Okech[1], Prof. Agatha Christine Onyango, PhD[1] & Dr. Florence O. Habwe, PhD[1]*

[1] Maseno University, P. O. Box 333, Maseno, Kenya.
*Author for Correspondence Email: oketchhazel@gmail.com

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Stunting, Underweight, Wasting, Socio-Demographic, Socio-Economic, Child Nutrition.

ABSTRACT

Child undernutrition remains a major public health concern in Kenya, especially in rural areas where food production does not always lead to improved nutritional outcomes. Despite national and county-level progress, localised disparities persist, highlighting the need for sub-county-level evidence. This study assessed the nutritional status of children aged 12–60 months and examined the influence of socio-demographic and socio-economic factors on stunting, wasting, and underweight in Navakholo Sub-County, Kakamega County. A cross-sectional study was conducted among 384 agricultural households using structured questionnaires and anthropometric assessments, with nutritional status classified using WHO child growth standards. Bivariate and multivariate logistic regressions were used to assess associations. Stunting prevalence was 23.4%, underweight 4.9%, wasting 1%, and overweight 5.5%. Stunting was significantly associated with Protestant religion (AOR=5.697; CI=1.881–17.260), geographic location—children in Shinoyi-Shikomari-Esumeiya Ward had reduced odds (AOR=0.324; CI=0.130–0.806)—and household head education, with the highest risk among children whose household heads had no formal education (AOR=21.012; CI=1.180–374.085). Wasting was associated with household income between KES 7,000–9,000 (AOR=5.143; CI=1.345–19.667) and tertiary education of the household head (AOR=12.110; CI=1.001–146.568). Underweight was associated with caregiver age 42–49 years (AOR=0.080; CI=0.009–0.688), having two (AOR=4.345; CI=2.259–8.356) or three or more children under five (AOR=8.951; CI=2.504–31.996), and was least likely among children in Bunyala East (AOR=0.070; CI=0.016–0.305). Localised disparities in child nutrition in Navakholo Sub-County are driven by socio-demographic and economic factors, highlighting the need for targeted, context-specific interventions.

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INTRODUCTION

In 2022, an estimated 149 million children under the age of five globally were affected by stunting, 45 million were wasted, and 37 million were either overweight or obese (World Health Organization, 2024). Undernutrition remains a significant contributor to child mortality, accounting for nearly half of all deaths in children under five, particularly in low- and middle-income countries (World Health Organization, 2024). In Africa alone, its prevalence rose from 19.4% in 2021 to 19.7% in 2022. About 17.1% of children under five in Africa were underweight in 2018, amounting to roughly 29 million children (Tamir et al., 2024). The effects of malnutrition are wide-reaching, with long-term consequences not only for the health and development of individual children but also for their families, communities, and national economies.

According to the 2022 Kenya Demographic and Health Survey (KDHS), 18% of children under five in Kenya are stunted, 5% are wasted, 3% are overweight, and 10% are underweight. Undernutrition remains a significant challenge in Kenya, primarily driven by socioeconomic disparities that limit access to nutritious food, quality healthcare, and education (KDHS, 2022). These rates are disproportionately higher among children from lower-income households, where food insecurity and poor maternal education exacerbate malnutrition risks. Based on KDHS data from 2014 and 2022, further analysis indicates that a child's age, sex (male), household socioeconomic status, and maternal factors significantly increase malnutrition risks, with socioeconomic status emerging as the largest contributing factor to health inequality (Okutse & Athiany, 2025). Geographically, rural areas in Kenya face greater challenges, with 22% of children stunted compared to 12% in urban areas. Wasting is also more prevalent in rural settings (6%) than in urban ones (4%), while 12% of rural children are underweight versus 8% in urban areas (KDHS, 2022). These high rates are driven by socio-demographic and socio-economic disparities, including limited healthcare access, lower maternal education, food insecurity, lower household income, and geographical isolation, all of which hinder adequate nutrition for children (KDHS, 2022).

Between 2014 and 2022, Kakamega County saw notable declines in stunting (25.4% to 12%), wasting (11.7% to 2%), and underweight prevalence (18.1% to 5%) (KDHS, 2014; KDHS, 2022), yet

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food insecurity remains a persistent challenge, with 33% of households experiencing shortages and 60% unable to access diverse diets (ALMA Scorecard Hub, Kenya, 2024). This is despite the county's reputation for fertile soils, sufficient rainfall, and significant food production in its rural areas (Liru & Heinecken, 2021). While national surveys provide insights into broader malnutrition trends, there is limited localised evidence on these trends and how different factors, including socio-demographic and socio-economic determinants, specifically shape child nutrition, especially at the sub-county level. Given that rural areas experience higher rates of malnutrition despite proximity to food production, in the case of Kakamega County, understanding the role of these factors at the local level is crucial. This study, therefore, aims to address this gap by examining sub-county-level child nutrition levels and how socio-demographic and socio-economic factors influence these outcomes among children aged 12 to 60 months in rural Kakamega, offering targeted insights to inform effective nutrition policies and interventions.

METHODOLOGY

Study Area

This study was conducted in Navakholo Sub-County, Kakamega County, Kenya. [CIAT], 2018). The agricultural landscape of Navakholo is dominated by smallholder farming systems where maize, beans, vegetables, and tea are commonly cultivated. Maize occupies the largest share of farmland, with households averaging approximately 0.75 acres per household. The soils are predominantly clay loam and sandy loam, which are well-suited for crop production. However, the region's heavy reliance on rainfed agriculture, coupled with increasing climate variability and declining soil fertility, poses significant risks to food and nutrition security (International Center for Tropical Agriculture [CIAT], 2018).

Households in the sub-county engage in agricultural activities, with most also practising livestock keeping, particularly cattle rearing and free-range poultry production. Beyond agriculture, small-scale businesses and motorbike transport services locally known as boda-boda constitute key livelihood activities that supplement household incomes. Despite the area's considerable agricultural potential, Navakholo faces notably poor child nutrition outcomes (Keding et al., 2022). Current data on the nutritional status of children in the area remains limited, which justified the need for this study to comprehensively assess the nutritional status among children aged 12–60 months in this rural agricultural setting and its determining factors.

Study Population

This study targeted agricultural households with children aged 12 to 60 months who had commenced complementary feeding in Navakholo Sub-County, which comprises 32,315 households according to the 2019 national census (KNBS, 2019). A sample size of 403 was included in the study. A proportionate sampling approach was used to allocate households across five wards based on population size. Community health volunteers provided household lists, from which systematic sampling with calculated intervals (ranging from every 2nd to every 4th household, depending on ward list size) selected participants, ensuring even distribution across ward populations.

Study Design

A cross-sectional study design was employed to assess the socio-demographic and socio-economic determinants of nutritional status among children aged 12-60 months.

Data Collection Tools

Data collection for this study was conducted using a structured questionnaire and an anthropometric assessment form. An anthropometric assessment was conducted to evaluate the nutritional status of children aged 12 to 60 months. Data collected included the child's date of birth, age in months, height, and weight. Age was confirmed through the

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community health promoter's database and either a birth certificate or the child's health booklet, depending on what was readily available. Weight and height were each measured thrice, with the average value recorded. A SECA 874 digital weighing scale was used for weight measurements. For children unable to stand on the scale, their weight was obtained by subtracting the caregiver's weight (recorded while carrying the child) from their own individual weight. A SECA 213 height board was used to measure standing height.

Data Analysis

Descriptive statistics, including frequencies, percentages, and means, were generated to summarise the data. Anthropometric data (height, weight, and age) were entered into ENA for SMART 2020 software to calculate Z-scores for height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ), based on WHO child growth standards. WHO growth charts were used for children 60 months of age. These indices were used to assess the nutritional status of the children.

For inferential analysis, the data were exported to R version 4.5.0, where both bivariate and multivariate logistic regression analyses were performed to examine the relationships between socio-economic and demographic factors and the nutritional status of children. These analyses aimed to determine the strength and direction of associations, with results interpreted at a 95% confidence level. A p-value of ≤ 0.05 was considered statistically significant.

Ethical Consideration

This study was conducted as part of the requirements for the award of a Master of Science degree in Community Nutrition and Development. Ethical approval was obtained from the Masinde Muliro University of Science and Technology Institutional Scientific and Ethics Review Committee (MMUST-ISERC), approval number MMUST/IERC/121/2023. Research authorisation was granted by the National Commission for Science, Technology, and Innovation (NACOSTI), license number NACOSTI/P/23/26202. Informed consent was obtained from all participating caregivers prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and their right to withdraw from the study at any time without penalty. All data were anonymised and used solely for research purposes in accordance with established ethical guidelines.

RESULTS

Socio-demographic Characteristics

A total of 403 households were recruited into the study. Of the 403 households, 384 completed the study as per the inclusion criteria. Demographic characteristics included gender and age of primary caregiver, household head and child, religion of primary caregiver, marital status of primary caregiver, primary caregiving status, number of household members, and children, including those 60 months and below, as shown in Table 1 below.

In the study, most caregivers were female, comprising 383 respondents (99.7%). Among all the primary caregivers, 323 (84.1%) were parents to the children involved. 61 (15.9%) were guardians. Among the 384 households included, 358 (93.2%) had male household heads. Of these, 340 (88.5%) were the caregivers' husbands, and 18 (4.7%) were their fathers. Additionally, most of the children included in the study were male, totalling 199 (51.8%).

In terms of age, most of the caregivers, 134 (34.9%), were aged 26–33 years, followed by those aged 18–25 years at 113 (29.4%). The older age groups, ranging from 58 to over 65 years, accounted for the fewest primary caregivers, with only 11 (2.8%). Similarly, most household heads, 116 (30.2%), were also within the 26–33-year age group, followed closely by those aged 34–41 years at 107 (27.9%). Only 17 (4.4%) of the household heads were above 65 years. Among the children, the majority, 105 (27.3%), were within the 30-31 months age bracket, while the least, 3 (0.8%), were 60 months of age.

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Christianity was common among the respondents of the study, with 361 (94%) subscribing to the faith. Only 23 (6%) subscribed to the Islamic faith. With regards to marital status, 352 (91.7%) of the respondents were married. The least, 4 (1%), were separated from their spouses. In terms of household size, 187 households (48.7%) had between 5 and 7 members, including children. This was followed by 125 households (32.6%) with 2 to 4 members. The least common were households with over 10 members, accounting for only 14 (3.6%). Regarding the number of children per household, the median was 1 to 3 children, reported by 212 households (55.2%). This was followed by 130 households (33.9%) with 4 to 6 children. Only 8 households (2.1%) reported having 10 or more children. Most households, 341 (88.9%), had one child within the 0–60 months age group, while 20 households (5.2%) had three or more children in this age group.

Table 1: Socio-demographic Characteristics

Characteristics	**n**	**(%)**
Distribution by location		
Bunyala West	104	27.1%
Bunyala East	61	15.9%
Bunyala Central	84	21.9%
Shinoyi- Shikomari-Esumeiya	75	19.5%
Ingotse- Matiha	60	15.6%
Gender of caregivers		
Male	383	99.7%
Female	1	0.3%
Household head characteristics		
Father	340	88.5%
Grandfather	18	4.7%
Mother	8	2.1%
Grandmother	18	4.7%
Gender of the children		
Male	199	51.8%
Female	185	48.2%
Age of caregivers (years)		
18-25	113	29.4%
26-33	134	34.9%
34-41	86	22.4%
42-49	25	6.5%
50-57	15	3.9%
58-65	4	1.8%
Above 65	7	1%
Age of household head (years)		
18-25	30	7.8%
26-33	116	30.2%
34-41	107	27.9%
42-49	56	14.6%
50-57	30	7.8%
58-65	28	7.3%
Above 65	17	4.4%
Age of children (months)		
12-17	56	14.6%

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Characteristics	n	(%)
18-29	96	25%
30-41	105	27.3%
42-53	75	19.5%
54-59	49	12.8%
60	3	0.8%
Religion of the caregiver		
Protestants	324	84.4%
Catholic	29	7.6%
African Initiated Churches	7	1.8%
SDA	1	0.3%
Muslim	23	6%
Marital status of the caregiver		
Single	11	2.9%
Married	352	91.7%
Separated	4	1%
Widowed	16	4.2%
Primary caregiving status		
Parent	323	84.1%
Guardian	61	15.9%
Number of household members		
2-4	125	32.6%
5-7	187	48.7%
8-10	58	15.1%
>10	14	3.6%
Number of children		
1-3	212	55.2%
4-6	130	33.9%
7-9	34	8.9%
≥10	8	2.1%
Number of children ≥ 60 months		
1	341	88.9%
2	123	32%
≥3	20	5.2%

Socio-economic Characteristics

Socioeconomic characteristics included source of income and income of primary caregiver and household head, amount of money spent on food per week on average, education and literacy levels of primary caregiver and household head. Regarding caregivers' income, 263 (68.5%) reported having a source of income. However, not all of them earned regularly. Among those with a regular income, the majority, 110 (28.6%), earned between 1,000 and 3,000 KES per month. Only a small proportion, 7 (1.8%), reported earning a regular monthly income of above 15000 KES. In the case of household heads, 378 (98.4%) had sources of income. Among those earning regularly, 269 (70%) had income between 1000 KES and 12000 KES. The highest proportion of respondents, 66 (17.2%), spent between 1101–1400 KES weekly, followed by 61 (15.9%) who spent over 2000 KES on food.

Education levels among respondents varied in this study. The majority, 375 (97.7%), had undergone formal education, followed by 225 (58.6%), having

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attained or completed primary education. Similarly, 366 (95.1%) of household heads had received some form of formal education, with 202 (52.6%) having attained or completed primary level. Literacy rates were also relatively high, with 288 (75%) of respondents and 297 (77.5%) of household heads able to read and write.

Table 2: Socio-economic Characteristics.

Characteristics	n	(%)
The source of income of the caregiver		
Has an income source	263	42.4%
No income source	121	31.5%
Income level of the caregiver		
Not disclosed	2	0.5%
None	147	38.3%
Less than 1000	51	13.3%
1000-3000	110	28.6%
4000-6000	43	11.2%
7000-9000	10	2.6%
10000-12000	8	2.1%
13000-15000	6	1.6%
16000-18000	2	0.5%
19000-21000	2	0.5%
22000-24000	0	0.0%
>24000	3	0.8%
Source of income of the household head		
Has income	378	98.4%
No income source	6	1.6%
Income level of household head		
Not disclosed	14	3.6%
None	15	3.9%
Less than 1000	17	4.4%
1000-3000	86	22.4%
4000-6000	88	22.9%
7000-9000	60	15.6%
10000-12000	35	9.1%
13000-15000	30	7.8%
16000-18000	8	2.1%
19000-21000	11	2.9%
22000-24000	2	0.5%
>24000	18	4.7%
Amount spent on food per week		
≤200	11	2.9%
201-500	45	11.7%
501-800	57	14.8%
801-1100	59	15.4%
1101-1400	66	17.2%
1401-1700	36	9.4%
1701-2000	49	12.8%
>2000	61	15.9%

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Characteristics	n	(%)
Education level of the caregiver		
No education	9	2.3%
Primary	225	58.6%
Secondary	117	30.5%
Vocational Training	4	1%
Tertiary	29	7.6%
Education level of household head		
No education	18	4.7%
Primary	202	52.6%
Secondary	117	30.5%
Vocational Training	5	1.3%
Tertiary	41	10.7%
Literacy level of the caregiver		
Can read and write	288	75%
Can write only	6	1.6%
Can neither read nor write	90	23.4%
Literacy level of the household head		
Can read and write	297	77.5%
Can write only	4	1%
Can neither read nor write	82	21.4%

Nutritional Status of Children Aged 12 to 60 Months

Nutritional Status of Children by Gender

A total of 384 children aged 12 to 60 months had their anthropometric measurements taken in this study. Among them, 199 (51.8%) were male, and 185 (48.2%) were female. Majority- 105 (27.3%) of the children in the study were between 30 and 41 months, followed closely by 96 (25%) aged 18 to 29 months. The least number of children, 3 (0.8%), were 60 months of age.

The prevalence of stunting in the study population was 90 (23.4%), with 65 (16.9%) children moderately stunted and 25 (6.5%) severely stunted. Male children exhibited higher stunting rates compared to females, with 56 (28.1%) of males affected. In comparison, females showed lower stunting rates at 34 (18.4%).

Regarding underweight status, the prevalence was 19 (4.9%). Similar to stunting, underweight rates were higher among males, with 12 (6%) underweight. Female children had lower rates at 7 (3.8%). Wasting rates were relatively low compared to stunting and underweight. Both moderate and severe wasting affected 1 child (0.5%) respectively. Moderate wasting rates were higher among males, with 3 cases (1.5%), whereas females recorded 1 case (0.5%). Severe wasting cases were equal across genders, with 1 child (0.5%) each.

For overweight status, based on weight-for-height z-scores (WHZ), the prevalence was 21 (5.5%), with 4 (1%) classified as severely overweight. Unlike stunting and underweight, overweight rates were higher among females at 14 (7.6%), compared to 11 (5.5%) among males, as shown in Table 3.

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Table 3. Prevalence Rates for Stunting, Wasting, Overweight and Underweight by Gender (n = 384)

Z score	n=384 (95% CI)	Male (n-199) (95% CI)	Female (n=185) (95% CI)
Stunting (HAZ Scores)			
<-2	90 (23.4%; 19.5-27.9)	56 (28.1%: 22.4-34.8)	34 (18.4%; 13.5-24.6)
<-2 - ≥-3	65(16.9%; 13.5-21.0)	40 (20.1%; 15.1-26.2)	25 (13.5%; 9.3-19.2)
<-3	25(6.5%; 4.4-9.4)	16 (8%; 5.0-12.7)	9(4.9%;2.6-9.0)
Wasting (WHZ Scores)			
>3	4 (1%; 0.4-2.6)	2(1%; 0.3-3.6)	12 (6.5%; 3.7-11.0)
>2	21 (5.5%; 3.6-8.2)	9 (4.5%; 2.4-8.4)	12 (6.5%; 3.7-11.0)
<-2	4 (1%; 0.4-2.6)	3 (1.5%; (0.5 - 4.3)	1(0.5 %; 0.1 - 3.0)
<-2 - ≥-3	2 (0.5 %; 0.1 - 1.9)	2 (1 %; 0.3 - 3.6)	0 (0.0 %; 0.0 - 2.0)
<-3	2 (0.5 %; 0.1 - 1.9)	1 (0.5 %; 0.1 - 2.8)	1 (0.5 %; 0.1 - 3.0)
Underweight (WAZ Scores)			
<-2	19 (4.9%; 3.2-7.6)	12 (6%; 3.5-10.2)	7 (3.8%; 1.8-7.6)
<-2 - ≥-3	13 (3.4%; 2.0-5.7)	9 (4.5%; 2.4-8.4)	4 (2.2%; 0.8-5.4)
<-3	6 (1.6%; 0.7-3.4)	3 (1.5%; 0.5-4.3)	3 (1.6%; 0.6-4.7)

Nutritional Status of Children by Age Group

Based on age groups, stunting rates were highest among children aged 18 to 29 months at 35(36.4%), with the highest prevalence of severe stunting at 13 (13.5%) and moderate stunting at 22 (22.9%). Children aged 30 to 41 months followed closely at 25(23.8%) stunting rate and exhibited elevated rates of moderate stunting, with 21 children (20%) affected. In terms of wasting, the prevalence of severe wasting was highest in the 12 to 17-month age group, with 1 child (1.8%) affected. Moderate wasting was observed in the 18 to 29-month age group, where 2 children (2.1%) were affected.

Overweight prevalence was highest among children aged 12 to 17 months, with 7 children (12.5%) classified as overweight. The 18 to 29-month age group followed closely, with 10 children (10.4%) classified as overweight and 3 children (3.1%) severely overweight.

Underweight prevalence was most notable in the 18 to 29-month age group, which recorded the highest prevalence of severe underweight with 3 children (3.6%) affected and the highest prevalence of moderate underweight with 4 children (4.2%), as shown in Table 4.

Table 4. Prevalence Rates for Stunting, Wasting, Overweight and Underweight by Age

Months	(> 3)	(> 2)	(> = -2)	(>= -3 & <-2)	(<-3)
Stunting (HAZ Scores)					
12-17	0	0	11 (19.6%)	5 (8.9%)	6 (10.7%)
18-29	0	0	35 (36.4%)	13 (13.5%)	22 (22.9%)
30-41	0	0	25 (23.8%)	4 (3.8%)	21 (20%)
42-53	0	0	10 (13.3%)	3 (4%)	7 (9.3%)
54-59	0	0	8 (15.4%)	0	8 (15.4%)
60	0	0	0/	0	0
Wasting (WHZ Scores)					
12-17	0	0	55 (98.2%)	0	1(1.8%)
18-29	0	0	93 (96.9%)	2 (2.1%)	1(1%)
30-41	0	0	105 (100%)	0	0
42-53	0	0	75 (100%)	0	0
54-59	0	0	49 (100%)	0	0

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Months	(> 3)	(> 2)	(> = -2)	(>= -3 & <-2)	(<-3)
60	0	0	3 (100%)	0	0
Underweight (WAZ Scores)					
12-17	0	7 (12.5%)	52 (92.9%)	2 (3.6%)	2 (3.6%)
18-29	3 (3.1%)	10 (10.4%)	89 (92.7%)	4 (4.2%)	3 (3.1%)
30-41	1 (1%)	3 (2.9%)	100 (95.2%)	4 (3.8%)	1 (1%)
42-53	0	1 (1.3%)	73 (97.3%)	2 (2.7%)	0
54-59	0	0	48(98%)	1 (2%)	0
60	0	0	3 (100%)	0	0

Prevalence of Stunting by Area

Bunyala West Ward experienced the highest overall stunting rates, with 31 (29.8%) of children affected. Of these, 22 (21.2%) were moderately stunted, and 9 (8.7%) were severely stunted. The ward also reported a 7 (6.7%) underweight prevalence, while overweight prevalence was 6 (5.8%). In Bunyala East Ward, stunting was observed in 15 (24.6%) of children, with 10 (16.4%) moderately stunted and 5 (8.2%) severely stunted.

In Bunyala Central Ward, stunting rates were also high, with 19 (22.6%) of children affected, including 16 (19.0%) with moderate stunting and 3 (3.6%) with severe stunting. The ward had an underweight prevalence of 6 (7.1%) and an overweight prevalence of 2 (2.4%). In Ingotse-Ematiha Ward, stunting was recorded in 15 (25.0%) of children, with 10 (16.7%) moderately stunted and 5 (8.3%) severely stunted. Underweight prevalence was 4 (6.7%), and overweight prevalence was 5 (8.3%).

Lastly, Shinoyi-Shikomari-Esumeiya Ward had a stunting prevalence of 13 (17.3%), with 9 (12.0%) moderately stunted and 4 (5.3%) severely stunted. Underweight prevalence was 3 (4.0%), and overweight was 4 (5.3%), as shown in the table below.

Table 5: Prevalence of Stunting, Wasting, Underweight and Overweight by Area

Indicator	Bunyala West (n=104)	Bunyala East (n=61)	Bunyala Central (n=84)	Ingotse-Ematiha (n=60)	Shinoyi-Shikomari-Esumeiya (n=75)
Stunting	**31 (29.8%)**	**15 (24.6)**	**19 (22.6)**	**15 (25.0)**	**13 (17.3)**
Moderate stunting	22 (21.2%)	10 (16.4%)	16 (19.0%)	10 (16.7%)	9 (12.0%)
Severe Stunting	9 (8.7%)	5 (8.2%)	3 (3.6%)	5 (8.3%)	4 (5.3%)
Underweight	**7 (6.7%)**	**0 (0.0%)**	**6 (7.1%)**	**4 (6.7%)**	**3 (4.0%)**
Moderate Underweight	6 (5.8%)	0 (0.0%)	4 (4.8%)	2 (3.3%)	1 (1.3%)
Severe Underweight	1 (1.0%)	0 (0.0%)	2 (2.4%)	1 (1.7%)	2 (2.7%)
Acute Malnutrition	1 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.3%)
Severe Acute Malnutrition	0 (0.0%)	0 (0.0%)	1 (1.2%)	1 (1.7%)	0 (0.0%)
Overweight	6 (5.8%)	5 (8.2%)	2 (2.4%)	5 (8.3%)	4 (5.3%)
Severe Overweight	2 (1.9%)	0 (0.0%)	0 (0.0%)	1 (1.7%)	1 (1.3%)

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Association between Socio-demographic and Socio-economic Characteristics and Nutritional Status of Children

These results show the emerging associations between socio-demographic and socio-economic factors and the nutritional status of children in terms of stunting, wasting, and underweight based on logistic regression analysis. Bivariate and multivariate logistic regressions were carried out, establishing crude odds and adjusted odds ratios.

The multivariate logistic regression analysis for stunting revealed several significant associations between socio-demographic and socio-economic characteristics and height-for-age z-scores. Geographic location demonstrated a protective effect, with children living in Shinoyi-Shikomari-Esumeiya showing reduced odds of stunting in both crude (COR 0.748, 95% CI: 0.596-0.938, p<0.05) and adjusted analyses (AOR 0.324, 95% CI: 0.130-0.806, p<0.05), with the protective effect becoming more pronounced after controlling for other variables.

Religious affiliation emerged as a risk factor, with children from Protestant households demonstrating increased odds of stunting in crude analysis (COR 4.258, 95% CI: 3.818-4.749, p<0.05), which strengthened after adjustment (AOR 5.697, 95% CI: 1.881-17.260, p<0.05), indicating these children were approximately six times more likely to be stunted compared to the reference group.

For the household heads, all education categories demonstrated increased stunting risk compared to the reference group. After adjustment, children from households where the head had no education faced the highest risk (AOR 21.012, 95% CI: 1.180-374.085,p<0.05), followed by those with tertiary education (AOR 12.155, 95% CI: 1.956-75.545,p<0.05), secondary education (AOR 10.187, 95% CI: 2.322-44.691,p<0.05), and primary education (AOR 6.733, 95% CI: 1.533-29.581,p<0.05), representing 21, 12, 10, and 7 times higher odds of stunting respectively. Notably, other factors assessed in this study, including the primary caregiving status, age, household size, number of children, household income, and literacy levels, were not significantly associated with child stunting. The table below shows in more detail the crude and adjusted odds ratios across different factors in relation to stunting.

Table 6: Association between Socio-demographic and Economic Characteristics and Stunting

Variable	Crude OR	95% CI	Adjusted OR	95% CI
Specific Location				
Shinoyi- Shikomari- Esumeiya	0.748	0.596-0.938	0.324	0.130-0.806
Bunyala West	1.457	1.201-1.767		
Religion of the caregiver				
Protestants	4.258	3.818-4.749	5.697	1.881-17.260
African Initiated churches	0.243	0.116-0.509		
Muslim	3.792	2.472-5.816		
Primary caregiving status				
Parent	0.885	0.793-0.987		
Age of caregivers (years)				
26-33	0.578	0.488-0.685		
34-41	0.443	0.359-0.548		
42-49	0.576	0.389-0.852		
Above 65	0.094	0.042-0.209		
Age of household head (years)				
34-41	0.564	0.467-0.682		
42-49	0.474	0.365-0.616		
Above 65	0.580	0.355-0.946		

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Variable	Crude OR	95% CI	Adjusted OR	95% CI
Household size				
5-7	0.845	0.732-0.976		
Number of children				
4-6	0.836	0.704-0.993		
7-9	0.553	0.393-0.778		
Number of children ≥ 60 months				
2	1.672	1.401-1.995		
The source of income of the caregiver				
No income source	1.609	1.345-1.924		
Income level of the caregiver				
Not disclosed	1.201	1.022-1.411		
7000-9000	0.425	0.229-0.791		
>24000	0.201	0.065-0.622		
Income level of household head				
10000-12000	0.551	0.395-0.767		
Amount spent on food per week				
501-800	1.375	1.061-1.783		
1701-2000	1.391	1.051-1.841		
Education level of household head				
No education	8.923	5.547-14.354	21.012	1.180-374.085
Primary	6.990	6.085-8.029	6.733	1.533-29.581
Secondary	8.385	6.996-10.051	10.187	2.322-44.691
Vocational Training	4.547	1.893-10.924		
Tertiary	8.923	5.547-14.354	12.155	1.956-75.545
Education level of caregivers				
Primary	1.892	1.658-2.158		
Secondary	2.168	1.809-2.599		
Vocational Training	0.242	0.091-0.644		
Tertiary	3.585	1.492-8.613		
Literacy of the household head				
Can write only	0.158	0.059-0.422		

Children in households where the head earns between 7,000 and 9,000 KES had a higher risk of wasting. The crude odds ratio was high (COR 83.171, 95% CI: 64.440–107.347p<0.05), but after adjusting for other factors, the odds were lower, though still significant (AOR 5.143, 95% CI: 1.345–19.667, p<0.05). Children in households where the head had tertiary education were about 12 times more likely to be wasted compared to those in households with less education. The crude odds ratio was 48.552 (95% CI: 30.183–78.102), and the adjusted odds ratio was 12.110 (95% CI: 1.001–146.568, p<0.05). Detailed results for both crude and adjusted odds ratios related to wasting (WHZ scores) are shown in Table 7.

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Table 7: Association between Socio-demographic and Economic Characteristics and Wasting

Variable	COR	95% CI	AOR	95% CI
Specific Location				
Bunyala West	0.822	0.678-0.997		
Bunyala East	0.022	0.017-0.029		
Ingotse- Ematiha	1.413	1.097-1.820		
Religion of the caregiver				
Protestants	36.264	32.517-40.442		
Muslim	0.449	0.293-0.688		
Primary caregiving status				
Parent	44.163	39.586-49.268		
Marital status of the caregiver				
Separated	0.228	0.074-0.707		
Single	0.088	0.049-0.160		
Widowed	0.067	0.041-0.109		
Household head characteristics				
Grandfather	0.060	0.038-0.095		
Mother	0.111	0.056-0.222		
Grandmother	0.062	0.039-0.100		
Age of caregivers (years)				
34-41	0.013	0.010-0.016		
42-49	0.036	0.024-0.053		
50-57	0.053	0.032-0.088		
58-65	0.150	0.056-0.400		
Above 65	0.108	0.048-0.240		
Age of household head (years)				
26-33	0.684	0.569-0.822		
34-41	0.364	0.301-0.440		
42-49	0.013	0.010-0.017		
50-57	0.022	0.015-0.031		
58-65	0.023	0.016-0.033		
Above 65	0.036	0.022-0.059		
Household size				
5-7	0.344	0.298--0.397		
≥10	0.060	0.035-0.101		
Number of children				
4-6	0.549	0.462-0.652		
7-9	0.032	0.023-0.045		
≥10	0.097	0.048-0.193		
Number of children ≥ 60 months				
2	1.957	1.640-2.335		
≥3	0.070	0.045-0.109		
The source of income of the caregiver				
No income source	2.179	1.822-2.606		
Income level of the caregiver				
Not disclosed	0.563	0.479-0.662		
4000-6000	1.945	1.443-2.623		
7000-9000	0.093	0.050-0.173		
10000-12000	0.108	0.054-0.215		

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Variable	COR	95% CI	AOR	95% CI
13000-15000	0.130	0.059-0.290		
>24000	0.215	0.069-0.667		
Income level of household head				
Not disclosed	0.276	0.207-0.367		
4000-6000	0.202	0.164-0.249		
7000-9000	83.171	64.440-107.347	5.143	1.345-19.667
10000-12000	0.315	0.226-0.439		
13000-15000	78.636	54.981-112.468		
16000-18000	262.782	131.415-525.467		
19000-21000	0.516	0.286-0.932		
Amount spent on food per week				
≤200	0.079	0.044-0.142		
201-500	0.026	0.019-0.035		
501-800	0.021	0.017-0.028		
801-1100	0.021	0.016-0.027		
1401-1700	2.097	1.513-2.907		
1701-2000	0.024	0.018-0.032		
≥2000	2.540	1.972-3.271		
Education level of household head				
No education	0.284	0.176-0.456		
Primary	4.318	3.759-4.960		
Secondary	14.853	12.391-17.804		
Tertiary	48.552	30.183-78.102	12.110	1.001-146.568
Education level of caregivers				
No education	0.054	0.027-0.107		
Primary	0.135	0.119-0.154		
Secondary	0.513	0.428-0.615		
Vocational Training	0.095	0.036-0.254		
Tertiary	0.080	0.033-0.191		
Literacy of caregivers				
Can read and write	69.614	62.021-78.136		
Literacy of the household head				
Can read and write	63.715	56.854-71.403		

The analysis of underweight (WAZ) revealed important associations across several factors. With respect to geographic location, three wards were associated with reduced odds of underweight in the crude analysis, including Ingotse-Ematiha, Shinoyi-Shikomari-Esumeiya, and Bunyala East. However, after adjusting for other variables, only Bunyala East remained statistically significant. Children residing in Bunyala East had markedly lower odds of being underweight, both in the crude model (COR=0.018; 95% CI: 0.0139–0.023; $p<0.05$) and after adjustment (AOR=0.070; 95% CI: 0.016–0.305; $p<0.05$), indicating a strong independent protective effect of living in this ward.

Caregivers aged 42 to 49 years showed protection against underweight in their children (COR 0.034, 95% CI: 0.023 – 0.050), (AOR 0.080, 95% CI: 0.009 – 0.688). No significant associations were observed for other age groups in the adjusted model. Households with two children aged 60 months and below showed increased odds of underweight in

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both crude (COR 3.349, 95% CI: 2.807–3.997, p<0.05) and adjusted analyses (AOR 4.345, 95% CI: 2.259–8.356, p<0.05). This pattern was stronger in households with three or more children aged 60 months and below, where the risk for underweight was 8 times higher (COR 6.375, 95% CI: 4.113–9.881, p<0.05), (AOR 8.951, 95% CI: 2.504–31.996, p<0.05). These results suggest that having more younger children presents considerable nutritional challenges.

As far as household head income was concerned, those with income in the 7,000 to 9,000 KES range had 3 times increased risk of underweight among their children (COR 4.146, 95% CI: 3.212–5.351, p<0.05), (AOR 3.051, 95% CI: 1.196 –7.781, p<0.05). Additionally, weekly food expenditure between 801 and 1,100 KES was protective for children underweight (COR 0.515, 95% CI: 0.399-0.664, p<0.05), (AOR 0.238, 95% CI: 0.077 – 0.737, p<0.05). Detailed results for both crude and adjusted odds ratios related to wasting (WHZ scores) are shown in Table 8.

Table 8: Association between Socio-demographic and Economic Characteristics and Underweight

Variable	COR	95% CI	AOR	95% CI
Specific Location				
Bunyala East	0.018	0.0139-0.023	0.070	0.016-0.305
Ingotse- Ematiha	0.698	0.542-0.899		
Shinoyi- Shikomari-Esumeiya	0.554	0.442-0.695		
Religion of the caregiver				
Protestants	1.498	1.343-1.671		
Muslim	2.933	1.912-4.498		
African initiated churches	0.160	0.076-0.336		
Primary caregiving status				
Parent	0.692	0.620-0.771		
Marital status of the caregiver				
Separated	6.550	2.113-20.310		
Single	0.091	0.050-0.164		
Widowed	0.066	0.041-0.108		
Household head characteristics				
Mother	0.116	0.058-0.232		
Age of caregivers (years)				
26-33	0.466	0.393-0.552		
34-41	0.433	0.351-0.535		
42-49	0.034	0.023-0.050	0.080	0.009-0.688
58-65	3.355	1.259-8.938		
Above 65	0.104	0.047-0.232		
Age of household head (years)				
26-33	2.476	2.061-2.975		
34-41	0.557	0.461-0.674		
50-57	2.038	1.425-2.916		
58-65	3.398	2.346-4.921		
Above 65	0.091	0.056-0.149		
Household size				
5-7	0.492	0.426-0.568		
≥10	2.358	1.397-3.982		
Number of children				
4-6	0.723	0.609-0.859		

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Variable	COR	95% CI	AOR	95% CI
7-9	0.574	0.408-0.807		
≥10	5.348	2.674-10.694		
Number of children ≥ 60 months				
2	3.349	2.807-3.997	4.345	2.259-8.356
≥3	6.375	4.113-9.881	8.951	2.504-31.996
The source of income of the caregiver				
No income source	1.616	1.351-1.933		
Income level of the caregiver				
Not disclosed				
4000-6000	0.664	0.565-0.780		
7000-9000	0.087	0.047-0.163		
10000-12000	0.099	0.050-0.199		
13000-15000	0.118	0.053-0.264		
>24000	0.200	0.065-0.621		
Income level of household head				
Not disclosed	3.046	2.289-4.055		
4000-6000	2.176	1.764-2.685		
7000-9000	4.146	3.212-5.351	3.051	1.196-7.781
13000-15000	3.159	2.209-4.518		
16000-18000	5.690	2.846-11.379		
19000-21000	4.225	2.340-7.629		
Amount spent on food per week				
≤200	2.762	1.530-4.988		
201-500	1.360	1.016-1.822		
501-800	1.623	1.252-2.104		
801-1100	0.515	0.399-0.664	0.238	0.077-0.737
1401-1700	1.712	1.235-2.374		
1701-2000	2.580	1.950-3.414		
≥2000	2.082	1.616-2.681		
Education level of household head				
No education	8.340	5.185-13.416		
Primary	8.415	7.326-9.666		
Secondary	7.767	6.480-9.310		
Tertiary	8.340	5.185-13.416		
Education level of caregivers				
No education	0.147	0.074-0.295		
Primary	1.311	1.149-1.495		
Secondary	2.023	1.688-2.425		
Vocational Training	0.232	0.087-0.618		
Tertiary	0.201	0.084-0.482		
Literacy of caregivers				
Can write only	0.130	0.059-0.290		
Can read and write	0.854	0.761-0.959		
Literacy of the household head				
Can write only	0.193	0.072-0.514		

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DISCUSSION

The study revealed that the stunting rate in Navakholo Sub-County was 23.4%, with underweight prevalence at 4.9%, wasting at 1%, and overweight at 5.5%. The stunting rate was significantly higher than the national rate of 18% and more than double that of Kakamega County, which stands at 11.5% (KDHS, 2022).

In contrast, this study found lower prevalence rates for underweight (4.9%) and wasting (1%) compared to the national averages of 10% and 5%, and Kakamega County's rates of 6.4% and 1.5%, respectively. The overweight prevalence of 5.5% was, however, higher than the national average of 3% and Kakamega County's rate of 4.5% (KDHS, 2022). In this study, boys exhibited higher rates of undernutrition compared to girls, with 28.1% stunted and 6% underweight, compared to 18.4% stunting and 3.8% underweight in girls. However, for overnutrition, girls showed higher prevalence rates than boys. These findings align with KDHS data (KDHS, 2022), which reported worse nutrition outcomes for males across all indicators except for overweight, where females had higher prevalence rates.

This trend is consistent with findings from Kassie and Workie (2020), who observed that among Ethiopian children under five, boys were more likely than girls to be underweight, stunted, or wasted. Similarly, a study by Tamir et al. (2024) found that boys had higher odds of stunting compared to girls, which was attributed to their higher caloric requirements.

In this study, stunting was most prevalent among children aged 18-29 months, with moderate stunting particularly high in those aged 30-41 months and severe stunting more common in children aged 12-17 months. These findings align with KDHS, which reported higher stunting rates among children aged 24-35 months, followed closely by those aged 12-23 months (KDHS, 2022). Similarly, Tamir et al. (2024) found that children aged 24 months and older had higher odds of stunting compared to those younger than 24 months, which could be attributed to the longer period of exposure to malnutrition among older children, as suggested by Wake et al. (2023).

In contrast to stunting, wasting in this study was higher among younger children, with severe wasting most prevalent in the 12-17-month age group and moderate wasting more common among children aged 18-29 months. This differs from the findings of Kassie and Workie (2020), who reported a directly proportionate increase in the risk of undernutrition with age, which was attributed to the late introduction of complementary foods with low nutritional quality. Additionally, KDHS found wasting to be more common among older children aged 36-59 months, which contradicts the findings of this study (KDHS, 2022).

Similarly, underweight rates in this study were highest among children aged 18-29 months, which contrasts with KDHS, where higher rates were observed among older children aged 24-59 months. However, similar to KDHS, this study found that overweight rates were higher among younger children compared to older children (KDHS, 2022). This is, however, in contrast to Diallo et al.'s study, which found the prevalence of overweight and obesity among children to increase with age owing to poor dietary practices and reduced levels of physical activity (Diallo et al., 2023).

According to this study, residing in Shinoyi-Shikomari-Esumeiya Ward was significantly associated with reduced odds of stunting, with children there about three times less likely to be stunted compared to other wards. The ward recorded a lower stunting prevalence (17.3%) relative to others in Navakholo Sub-County, highlighting intra-subcounty disparities. For underweight, crude odds ratios suggested that 3 wards, Ingotse-Ingotse-Ematiha, Shinoyi-Shikomari-Esumeiya, and Bunyala East, were associated with lower risk; however, after adjusting for confounding variables, only Bunyala East

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remained statistically significant. These findings agree with the argument by Kandala et al. (2021) that sub-national, place-based nutrition estimates are crucial for identifying geographic inequities often concealed by national statistics. Similarly, Seifu et al. (2024) highlighted spatial heterogeneity in child nutrition outcomes in Ethiopia, linking them to localised challenges such as agricultural limitations, environmental stressors, poor healthcare access, and infrastructure disparities within areas in the same region. The significant protective effects observed in Shinoyi-Shikomari-Esumeiya and Bunyala East suggest the existence of favourable localised conditions, such as better agricultural productivity, improved access to health services, or more effective implementation of nutrition interventions that may contribute to better nutrition outcomes for children in these wards (Seifu et al., 2024).

The high prevalence of Christianity (94%) among respondents is consistent with the religious landscape of Western Kenya and aligns with national trends where 86% practice Christianity (KNBS, 2019). Studies have shown that religious beliefs shape dietary behaviours, including child nutrition and, consequently, influence nutritional outcomes (Lokossou et al., 2021). In this study, religious affiliation was as a significant risk factor, with children from Protestant households exhibiting higher odds of stunting in both crude and adjusted models (COR 4.258, 95% CI: 3.818–4.749, $p<0.05$; AOR 5.697, 95% CI: 1.881–17.260, $p<0.05$). These findings contrast with those of Kirabira (2016), whose study in Obunga Slums, Kisumu County, found no significant association between Protestant affiliation and child nutritional status, though Pentecostal and Evangelical affiliations appeared to have a protective effect against stunting. Similarly, a study by Ndovie et al. (2025) in Malawi reported no association between stunting and Protestant affiliation but found that Muslim households had higher susceptibility to child wasting compared to their Christian counterparts. However, in the current study, Muslim affiliation was associated with a protective effect against wasting based on crude analysis (COR 0.449, 95% CI: 0.293–0.688, $p<0.05$), though this was not statistically significant after adjustment. These different findings across contexts underscore Lokossou et al.'s assertion that while religious affiliation does influence child nutrition, its effects are likely context-dependent and mediated by local cultural norms and socioeconomic conditions, warranting further investigation.

Men constituted 93.2% of household heads in this study, a finding consistent with Ampim et al. (2021), who observed that male household headship remains a prevailing norm across Sub-Saharan Africa. However, the relationship between household head education and child undernutrition was complex, with increased likelihood of stunting observed across education levels. Similarly, children in households where the head had tertiary education were about 12 times more likely to be wasted compared to those in households with less education. These findings contradict those of Vollmer et al. (2016), who emphasised the protective role of both maternal and paternal education in reducing child undernutrition, and those of Alderman and Headey (2017), who found maternal education to be more impactful on child nutrition. In this case, the education level of the primary caregiver had no significant association with stunting or wasting. These differences may be explained by the observation that men, regardless of education level, often prioritise income-generating activities over direct childcare or avoid involvement in nutrition-related decisions due to stigma and entrenched gender norms that associate such roles with women (Muthiru & Bukachi, 2024). Moreover, highly educated household heads are more likely to pursue careers outside agriculture, which may reduce access to diverse, home-produced foods and diminish household dietary diversity, further exacerbating the risk of undernutrition among children (Mgomezulu et al., 2024).

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In this study, having more than one child under the age of five in a household was associated with a fourfold increase in the odds of underweight among children, even after adjustment. This finding aligns with Guyatt et al. (2020), who reported similar associations in South East Kenya, highlighting the presence of multiple young children as a significant risk factor for undernutrition. These results reflect the implications of short birth spacing (SBS), which can deplete maternal nutrient stores, reduce breast milk quality, and limit caregiving time, thus compromising child nutrition (Foyez Ahmmed et al., 2024).

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study found that undernutrition remains a significant concern among children aged 12 to 60 months in Navakholo Sub-County, with stunting rates notably higher than the national and county averages. While wasting and underweight prevalence were relatively low, the presence of geographic, socioeconomic, and demographic disparities reveals an uneven distribution of risk across the sub-county. Key determinants of nutritional status included location, religious affiliation, education level of household heads, number of children under five, and household income and food expenditure. Contrary to expectations, higher education among household heads was associated with increased odds of stunting and wasting, possibly due to reduced involvement in caregiving or dietary decision-making. These findings emphasise the complexity of nutrition outcomes and the need to consider local context in nutrition programming.

Recommendations

Efforts to reduce child undernutrition in Navakholo Sub-County should combine targeted interventions in high-burden areas like Bunyala West with learning from better-performing wards such as Shinoyi-Shikomari-Esumeiya and Bunyala East. Applying a positive deviance approach to research can help identify successful local practices and behaviours that contribute to improved nutritional outcomes, offering valuable insights for wider application, ensuring sustainable, community-owned solutions that are responsive to local realities.

Programs should be co-designed with caregivers, local leaders, and service providers to ensure they are culturally appropriate and grounded in community realities. Leveraging existing social and religious structures, particularly the influence of trusted religious leaders, can enhance evidence-based nutrition literacy and support behaviour change in areas such as child feeding, caregiving, and health-seeking.

Given the predominance of male household heads as decision-makers, efforts to involve men in child nutrition must be culturally sensitive and considerate of their work schedules and roles. Community-based and flexible approaches, such as using farmer groups, local events, or religious gatherings, can create space for men to engage meaningfully without disrupting livelihoods or reinforcing gender tensions.

In addition, family planning and birth spacing education should be integrated into nutrition interventions to help households better manage caregiving and resource allocation. Reducing the number of young children in a household can ease pressure on caregivers and improve the quality of nutrition and care provided.

Finally, it is essential to institutionalise routine ward-level nutrition data collection and use. Building local capacity for monitoring and decision-making will ensure timely, responsive, and equitable nutrition programming across the sub-county.

Conflict of Interest

The authors declare no conflict of interest.

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