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The Hidden Burden of Malnutrition among Children with Cerebral Palsy in Malawi: A Cross-Sectional Study

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Abstract

Introduction:

Cerebral palsy (CP) increases the risk of undernutrition. In Malawi, little is known about the nutritional status and risk factors for malnutrition among children with CP. This study aimed to determine the prevalence of undernutrition and its associated risk factors among children with CP attending the Zomba Central Hospital Physiotherapy clinic in Southern Malawi.

Methods

This cross-sectional study was conducted between July and October 2024. A total of 123 children with CP, aged between 6 months to 18 years, were enrolled. Data on socio-demographic characteristics and comorbidities were collected through an interviewer-administered questionnaire. Anthropometric measurements were performed. Nutritional status was evaluated using both the World Health Organization (WHO) growth charts and the CP-specific growth charts. Statistical analyses included descriptive statistics, simple logistic regression and multivariate logistic regression to assess associations and determinants of undernutrition status.

Results

The prevalence rates of stunting, wasting, and underweight were 71.6%, 37.4%, and 62.7%, respectively. Children with feeding difficulties were more likely to be underweight (AOR = 2.79; CI: 1.18, 6.59; p = 0.019) and wasted (AOR = 3.84; CI: 1.38–10.67; p = 0.010). Frequent utilisation of nutritional health services positively predicted wasting; monthly (AOR = 8.70; CI: 2.50–30.24; p = 0.004) and weekly (AOR = 6.48; CI: 2.25–18.66; p = 0.001). Additionally, children aged 5–18 years had significantly greater odds of being wasted than those under 5 years (AOR = 3.23; CI: 1.02, 10.19; p = 0.046).

Conclusion

For children with CP in Malawi, feeding difficulties, frequent use of nutritional health services, and older age are significant predictors of malnutrition. There is, therefore, a need for context-specific, evidence-based and targeted nutritional interventions to address these critical risk factors to improve health outcomes and quality of life.

Background

Cerebral palsy (CP) is a neurodevelopmental condition occurring in the developing brain that affects the musculoskeletal system, leading to limitations in mobility, physical activity, and posture [1]. CP remains one of the leading causes of childhood disability worldwide, affecting approximately 50 million people

[2]. Globally, the prevalence ranges from 2 to 3 cases per 1000 live births [3]. However, the prevalence of CP in low- and middle-income countries (LMIC) is estimated at 3.1 to 3.7 per 1000 live births [3]. Furthermore, CP contributes to approximately 80% of all childhood disabilities in LMIC, which is double that of high-income countries (HIC) [4]. Data on the prevalence of CP in sub-Saharan Africa (SSA) are limited.

Children with CP have multiple comorbidities, and as such, they require multidisciplinary care [5–6]. However, a significant yet often neglected co-morbidity that children with CP have is malnutrition in the form of undernutrition [7]. Undernutrition among children with CP is a global challenge, with prevalence rates varying across regions. Undernutrition affects approximately 30% – 86% of children with CP globally [8–9]. In Sub-Saharan Africa (SSA), the prevalence is alarmingly high, ranging from 45.5% to 83% of this population [7], with prevalence rates varying widely in populations studied, geographical region, socioeconomic context, and the criteria used to define malnutrition [10]. Addressing malnutrition among children with CP is essential not only for improving their overall functional outcomes but also for reducing CP mortality, improving the quality of life and easing the associated burden on families and the healthcare systems.

Undernutrition in children with CP often results from a combination of factors, including functional limitations that lead to feeding difficulties, swallowing incoordination, which can lead to extended feeding times, aspiration pneumonia and inadequate nutrition intake [11–13]. Additionally, some children with CP may have higher energy requirements due to muscle spasticity or involuntary movements [14], while limited mobility can impact appetite and overall nutritional status [15]. Recurrent infections, gastrointestinal issues, or other health complications can further contribute to malnutrition, highlighting the need for comprehensive nutritional support [16–17]. Inadequate energy intake negatively impacts growth and well-being [18]. Malnutrition in itself is an independent risk factor for poor prognosis of individuals with chronic illnesses such as CP [4], as it influences immunological, neurological and cognitive impairment [18].

Currently, Malawi continues to grapple with malnutrition, where 38% of children under five years of age are suffering from chronic malnutrition (stunting), 2% being wasted, and 10% are underweight [7]. This situation is alarming, especially considering the country's efforts to address these issues such as the National Multisector Nutrition Policy and Strategic Plan, which aims to reduce malnutrition and improve child health outcomes [19]. Additionally, the country's food insecurity is further complicated by poverty, climate-related shocks, and limited access to healthcare services [20]. According to the 2025 Global Report on Food Crises, over 6.8 million Malawians are unable to meet their basic food needs, highlighting the severity of the issue [20]. Therefore, children with CP in Malawi would be disproportionately affected by a nutrition crisis, facing increased risks of malnutrition, health complications, and developmental setbacks due to their already heightened vulnerability. To our knowledge, there is limited data on the nutritional status of children with CP in Malawi. This study, therefore, aimed to describe the nutritional status and factors associated with malnutrition among

children with CP presenting at the Malawi Against Physical Disabilities (MAP) clinic at Zomba Central Hospital (ZCH).

Methods

Study Design, Period and Place

This was a hospital-based cross-sectional study conducted at the MAP clinic at ZCH. Data was collected between July and October 2024. ZCH is a tertiary referral facility that provides specialised healthcare services to a catchment population of approximately 4,282,329 individuals in Malawi's southern region at the time of the study. ZCH offers a wide range of services, including paediatric rehabilitation services, tailored to address the needs of children with physical disabilities, including children with CP. The hospital collaborates with MAP, an organisation dedicated to promoting the rights and well-being of individuals with Physical disabilities, in providing paediatric rehabilitation services.

The MAP clinic at ZCH provides care for approximately 70 children with CP monthly and attends to inpatients across the various paediatric wards within the hospital.

Study Population

The study population included children and adolescents with CP aged between 6 months and 18 years who attended the physiotherapy clinic at MAP and were diagnosed with CP by a certified clinician. Participants' Medical records were reviewed to confirm the CP diagnosis.

Inclusion criteria

The study included children who were between 6 months and 18 years of age with a confirmed diagnosis of CP by clinician in accordance with the definition and diagnostic criteria established by the Surveillance of CP in Europe (SCPE) [21], and whose parent/guardian consented to participate in the study.

Exclusion criteria

We excluded children who had other chronic illnesses that would affect nutrition other than CP. These conditions included: cardiac, renal disease or Human Immunodeficiency Virus (HIV) infection, which could independently influence nutritional status; those with congenital malformations like cleft lip and /or palate; and children with acute illness admitted to the health facility.

Sample size and selection

The sample size was determined using the single-population proportion formula, assuming a 50% prevalence of malnutrition among children with CP, a conservative estimate due to the lack of local data. With a 95% confidence level and a 5% margin of error, the initial sample size of 384 was adjusted using the finite population correction to yield a maximum of 130 eligible children and a minimum required sample of 96. To accommodate potential non-response or incomplete data, the target sample was increased by 20%, resulting in a required sample of at least 115 children. Ultimately, 123 children were included. A simple random sampling technique was employed to select participants from the sampling frame of 130 eligible children. Each child was assigned a unique identification number, and the Excel '=RAND ()' function was used to generate a random number for each entry. The list was then sorted in ascending order of the generated random values, and the first 123 children were selected. This approach ensured that every eligible child had an equal and independent chance of inclusion, minimising selection bias and enhancing the representativeness of the study sample.

Data collection

Data collection for this study was conducted through face-to-face interviewer-guided interviews with caregivers of children with CP using a structured questionnaire, developed for this study (Supplementary 1). Collected data included socio-demographic characteristics, medical history, and feeding practices. The medical records were reviewed to collect and confirm information on the children's medical history, comorbidities, and medications that could affect their nutritional status. We conducted anthropometric measurements using WHO standard operating procedures [22] to assess the nutritional status of children, and these measurements included weight, height, and mid-upper arm circumference (MUAC). Weight was measured using a hanging scale, which was calibrated before each use to ensure accuracy. The children were weighed while wearing minimal clothing, and the weight was recorded in kilograms (kg) to the nearest 100 g. Height was measured using recumbent length for participants who were unable to stand or had limited mobility. Recumbent length was measured for children who were unable to stand. The child's head was aligned against the top of the headboard of the length board. An assistant straightened the child's body and legs, ensuring that the feet were parallel to the footboard. Measurements were recorded in centimetres to the nearest 0.1 cm. Mid-upper arm circumference was measured on the left arm using a standard MUAC tape. The midpoint between the tip of the shoulder and the tip of the elbow was identified with the arm flexed at 90°, after which the arm was straightened and the tape applied with appropriate tension. The measurement was read at the indicator window and recorded in centimetres (cm) to the nearest 0.1 cm. The principal Investigator and a trained qualified nurse conducted the data collection.

Nutritional status was determined using the WHO classification, CP-specific growth chart, and based on MUAC. The World Health Organisation standard growth charts were used to assess growth and development in children under 5 years. The CP Growth Chart (CPGC) was also used to assess the growth and development of children aged 2–18 years with CP. Once the different anthropometric measurements were collected, they were plotted on CP growth charts to provide specific weight-for-age percentiles based on the growth chart patterns of children with CP, for appropriate interpretation. All anthropometric

measurements were converted to z-scores using the WHO Anthro software for children aged 0–5 years and the WHO Anthro Plus Software for children aged 5–18 years. While estimating z-scores, the measures of children with CP were compared with the WHO reference curve for the general population. Multiple indices were used to determine the nutritional status. The weight-for-height z-score (WHZ) and MUAC-for-age z-score (MUACZ) were calculated for children aged ≤ 61 months; the weight-for-age z-score (WAZ) was measured for children aged ≤ 121 months; the height-for-age z-score (HAZ) was measured in children under 18 years.

Data Management

Collected data were entered into the Kobo toolbox platform, which was used to digitise the extraction tool. The Kobo Toolbox is an Android application with a data extraction questionnaire and is used for data collection. This Kobo toolbox enabled data entry on tablets running Android. Data was routed to a designated server daily. Data was stored and password-protected on a private computer, to prevent unauthorised access or loss and to maintain privacy and confidentiality. The data were downloaded from Excel and exported to Stata version 17.0 for data cleaning, coding, and analysis.

Data Analysis

Descriptive statistics, including means, medians, frequencies, and proportions, were employed to summarise the socio-demographic and clinical characteristics of the study participants. The frequency distributions of nutritional status by factors were constructed. Bivariate analysis was conducted to explore associations between independent variables and nutritional status. Logistic regression analyses were performed to identify factors associated with undernutrition. The 95% confidence intervals (CIs) for both crude odds ratios (CORs) and multivariate logistic regression were used to identify predictors of malnutrition, and the adjusted odds ratios (AORs) were computed and reported. Statistical results were considered significant when $P < 0.05$. The model was adjusted for key covariates identified a priori and based on existing literature, including the child's age, level of motor impairment as classified by the Gross Motor Function Classification System (GMFCS) [23], presence of feeding difficulties, seizure history, caregiver education level, household income, feeding frequency, and access to health services. The GMFCS levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V).

Results

A total of 128 participants were screened for the study. Of these, 123 participants met the inclusion criteria and were enrolled. Five participants were excluded; two because were acutely

ill and referred to the inpatient therapeutic services (ITS) for management of severe wasting and/or nutritional oedema, while three had medical conditions unrelated to CP. Figure 1 illustrates the participant screening, inclusion and exclusion from the study.

Socio-demographic Characteristics of the participants

Table 1 presents the socio-demographic characteristics of the 123 children. The majority of participants (79.7%) were from rural areas, and over 75% of the children were under 5 years old. Most participants (93.5%) were being looked after by their mothers, and nearly three-quarters (74.0%) lived with both parents.

Table 1
Socio-demographic characteristics of participants

Variable	Frequency	Percentage
Gender		
Male	84	68.3
Female	39	31.7
Residence		
Urban	25	20.3
Rural	98	79.7
Place of birth		
Hospital	122	99.2
Home	1	0.8
Religion		
Christian	100	81.3
Muslim	23	18.7
Caregiver		
Mother	115	93.5
Others	8	6.5
Caregiver marital status		
Never	17	13.8
Married	91	74.0
Divorced	15	12.2
Caregiver education		
None	3	2.4
Primary	71	57.7
Secondary	43	35.0
Higher	6	4.9
Caregiver occupation		
Unemployed	48	60.1
Employed	13	10.6

Variable	Frequency	Percentage
Business	36	29.3
Child’s age (Years)		
Under 5	95	77.2
5–9	23	18.7
10–15	5	4.1
16–18	0	0

Prevalence of undernutrition in the study participants

Figure 2 shows the prevalence of underweight in children with CP using the normal growth charts and the CP growth charts. Notably, the prevalence of underweight was higher (58%, n = 56) when assessed using the normal growth charts than the CP growth charts (49.3%, n = 35).

Figure 3 presents the prevalence of stunting and wasting in children with CP. Stunting was more prevalent in the study population (71%, n = 68) while wasting affected 37% (n = 46).

Table 2 depicts the prevalence distribution of undernutrition among children with CP across socio-demographic categories. The prevalence of all forms of undernutrition was higher among children from rural areas than among children from urban areas for wasting, stunting, and underweight. Furthermore, a higher prevalence of all forms of undernutrition was observed among children whose caregivers had lower levels of education compared with those whose caregivers had secondary or higher education. Children with feeding difficulties consistently exhibited higher rates of wasting, stunting, and being underweight than those without feeding problems. An age gradient was also evident, with wasting increasing with advancing child age, reaching its highest levels among children aged 5–15 years, suggesting cumulative nutritional compromise over time among children with CP.

Table 2
Prevalence distribution of undernutrition among children with CP across socio demographic factors

Variable	With Wasting		With Stunting		With Underweight	
	Yes	No	Yes	No	Yes	No
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sex						
Male	29 (34.5)	55 (65.5)	47 (68.1)	22 (31.8)	37 (53.6)	32 (46.4)
Female	17 (43.6)	22 (56.4)	21 (80.8)	5 (19.2)	19 (73.1)	7 (26.9)
Residence						
Urban	7 (28.0)	18 (72.0)	13 (65.0)	7 (35.0)	9 (45.0)	11 (55.0)
Rural	39 (39.8)	59 (60.2)	55 (73.3)	20 (26.7)	47 (62.7)	28 (37.3)
Caregiver						
Mother	41 (35.7	74 (64.3)	65 (72.2)	25 (27.8)	53 (58.9)	37 (41.1)
Others	5 (62.5)	3 (37.5)	3 (60.0)	2 (40.0)	3 (60.0)	2 (40.0)
Caregiver marital status						
Never	9 (52.9)	8 (47.1)	9 (69.2)	4 (30.8)	8 (61.5)	5 (38.5)
Married	29 (31.9)	62 (68.1)	49 (71.0)	20 (29.0)	40 (58.0)	29 (42.0)
Divorced	8 (53.3)	7 (46.7)	10 (76.9)	3 (23.1)	8 (61.5)	5 (38.5)
Caregiver education						
None	2 (66.7)	1 (33.3)	2 (66.7)	1 (33.3)	2 (66.7)	1 (33.3)
Primary	23 (32.4)	48 (67.6)	37 (69.8)	16 (30.2)	29 (54.7)	24 (45.3)
Secondary	20 (46.5)	23 (53.5)	27 (81.8)	6 (18.2)	24 (72.7)	9 (27.3)
Higher	1 (16.7)	5 (83.3)	2 (33.3)	4 (66.7)	1 (16.7)	5 (83.3)
[#]GMFCS						
Mild-moderate	30 (37.5)	50 (62.5)	46 (69.7)	20 (30.3)	41 (62.1)	25 (37.9)
Severe	15 (35.7)	27 (64.3)	22 (75.9)	7 (24.1)	15 (51.7)	14 (48.3)
Health facility visit frequency						

Key: N/A = Not Applicable since stunted and underweight were tested on children under 5 years old only; [#] Gross Motor Function Classification System (GMFCS) levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V)

Variable	With Wasting		With Stunting		With Underweight	
Monthly	11 (55.0)	9 (45.0)	10 (58.8)	7 (41.2)	11 (64.7)	6 (35.3)
Rarely	14 (20.6)	54 (79.4)	35 (67.3)	17 (32.7)	27 (51.9)	25 (48.1)
Weekly	21 (60.0)	14 (40.0)	23 (88.5)	3 (11.5)	18 (69.2)	8 (30.8)
Feeding Problem						
Yes	32 (52.5)	29 (47.5)	33 (76.7)	10 (23.3)	31 (72.1)	12 (27.9)
No	14 (22.6)	48 (77.4)	35 (67.3)	17 (32.7)	25 (48.1)	27 (51.9)
Food Consistency						
Blended	31 (49.2)	32 (50.8)	31 (72.1)	12 (27.9)	29 (67.4)	14 (32.6)
Liquid	1 (25.0)	3 (75.0)	3 (75.0)	1 (25.0)	3 (75.0)	1 (25.0)
Solid	14 (25.0)	42 (75.0)	34 (70.8)	14 (29.2)	24 (50.0)	24 (50.0)
Caregiver age						
16 to 24	16 (29.6)	38 (70.4)	34 (72.3)	13 (27.7)	27 (57.5)	20 (42.5)
25 to 34	19 (41.3)	27 (58.7)	22 (68.7)	10 (31.3)	19 (59.4)	13 (40.6)
35 and above	11 (47.8)	12 (52.2)	12 (75.0)	4 (25.0)	10 (62.5)	6 (37.5)
Age						
0–4	28 (29.8)	66 (70.0)	68 (71.6)	27 (28.4)	56 (58.9)	39 (41.1)
5–9	13 (54.2)	11 (45.8)	N/A	N/A	N/A	N/A
10–15	5 (100.0)	0 (0.0)	N/A	N/A	N/A	N/A
Total	**46 (37.4)**	**77 (62.6)**	**68 (71.6)**	**27 (28.4)**	**56 (58.9)**	39 **41.1)**

Key: N/A = Not Applicable since stunted and underweight were tested on children under 5 years old only; # Gross Motor Function Classification System (GMFCS) levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V)

Table 3 shows the association between selected factors and underweight among the children with CP. Children with notable feeding problems had a threefold likelihood of being underweight than those who did not, and feeding problems was an independent predictor for underweight.

Table 3
Association between selected factors and underweight among children with CP

Variable	COR	95% CI	p-value
Caregiver education			
None*			
Primary	0.60	[0.05, 7.08]	0.686
Secondary	1.33	[0.11, 16.57]	0.823
Higher	0.10	[0.01, 2.50]	0.161
Residence			
Rural*			
Urban	0.49	[0.18, 1.32]	0.158
Problems feeding			
No*			
Yes	2.79	[1.18, 6.59]	0.019
Sex			
Female*			
Male	0.43	0.16, 1.14]	0.090
Frequency of Health Facility Visits			
Rarely*			
Monthly	1.70	[0.5, 5.27]	0.360
Weekly	2.08	0.77, 5.63]	0.148
Food consistency			
Solid*			
Blended	2.07	[0.88, 4.88]	0.094
Liquid	3.00	[0.29, 30.92]	0.356
GMFCS			
Mild-moderate*			
Severe	0.65	[0.27, 1.58]	0.33
Care giver			

Variable	COR	95% CI	p-value
Mother*			
Others	1.05	[0.167, 6.58]	0.961

*Key: * =Reference category; # Gross Motor Function Classification System (GMFCS) levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V).*

Table 4 shows key associated factors and predictors of wasting among children with CP. Notably, feeding problems, frequent utilisation of nutritional health services, and older age (5–18 years) were independent and significant predictors of wasting.

Table 4
Predictors of wasting in children with CP

Variable	COR	95% CI	p-value	AOR	95% CI	P-value
Caregiver education						
None*						
Primary	0.23	[0.02, 2.78]	0.253	-	-	-
Secondary	0.43	[0.04, 5.16]	0.509	-	-	-
Higher	0.10	[0.01, 2.50]	0.161	-	-	-
Residence						
Rural*						
Urban	0.59	[0.22, 1.54]	0.280	-	-	-
Problems Feeding						
No*						
Yes	3.78	[1.74, 8.25]	0.001	3.84	[1.38, 10.67]	0.010
Sex						
Female*						
Male	0.68	[0.31, 1.48]	0.335	-	-	-
Frequency of Health Facility Visits						
Rarely*						
Monthly	4.71	[1.63, 13.59]	0.004	8.70	[2.50, 30.24]	0.001
Weekly	5.78	[2.36, 14.17]	< 0.001	6.48	[2.25, 18.66]	0.001
Food Consistency						
Solid*						
Blended	2.91	[1.33, 6.35]	0.007	1.13	[0.41, 3.10]	0.819
Liquid	1.00	[0.10, 10.41]	1.00	0.79	[0.05, 12.20]	0.867
Age						
0–4*						
5–18	2.79	[1.11, 6.97]	0.028	3.23	[1.02, 10.19]	0.046
#GMFCS						
Mild*						

Variable	COR	95% CI	p-value	AOR	95% CI	P-value
Moderate	0.93	[0.43, 2.01]	0.846	-	-	-
Care giver						
Mother*						
Others	3.01	[0.68, 13.23]	0.145	-	-	-

*NB: * = Reference category; # Gross Motor Function Classification System (GMFCS) levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V).*

Table 5 shows factors associated with stunting among children with CP. Notably, stunting was not statistically significantly associated with any tested characteristics among the children in the study.

Table 5
Association of selected characteristics with stunting in children with CP

Variable	COR	95% CI	P-value
Caregiver education			
None*			
Primary	1.16	[0.10, 13.68]	0.908
Secondary	2.25	[0.17, 29.06]	0.534
Higher	0.25	[0.01, 4.73]	0.355
Residence			
Rural*			
Urban	0.68	[0.24, 1.93]	0.464
Problems feeding			
No*			
Yes	1.60	[0.64, 4.00]	0.312
Sex			
Female*			
Male	0.51	[0.17, 1.53]	0.228
Frequency of Health Facility Visits			
Rarely*			
Monthly	0.69	[0.22, 2.14]	0.525
Weekly	3.72	[0.98, 14.16]	0.054
Food Consistency			
Solid*			
Blended	1.06	[0.43, 2.65]	0.894
Liquid	1.24	[0.12, 12.92]	0.860
#GMFCS			
Mild-moderate*			
Severe	1.37	[0.50, 3.71]	0.540
Care giver			

Variable	COR	95% CI	P-value
Mother*			
Others	0.58	[0.09, 3.66]	0.560

*Key: *=Reference category, and testing at 0.05 significance level; #Gross Motor Function Classification System (GMFCS) levels were dichotomised for analysis as mild–moderate impairment (Levels I–III) and severe impairment (Levels IV–V).*

Discussion

This study examined the nutritional status and associated risk factors among children with CP at Zomba Central Hospital in Malawi. In this cohort of children with CP attending a tertiary rehabilitation service in Southern Malawi, undernutrition was pervasive, affecting both linear growth and acute nutritional status. Feeding difficulties were the most consistent and clinically relevant determinant of malnutrition, independently predicting both underweight and wasting, while older age was associated with a higher likelihood of wasting, suggesting cumulative nutritional compromise over time. Frequent attendance at nutritional health services was also associated with wasting, likely reflecting late presentation or reactive rather than preventive nutritional care. Together, these findings underscore the central role of feeding-related dysfunction and the importance of integrating proactive, CP-specific nutritional assessment and intervention into routine paediatric rehabilitation care.

Differences in malnutrition across growth references further emphasise the need for careful interpretation of anthropometry in children with CP. CP-specific growth charts, therefore, provide a more realistic assessment, despite some literature advocating the use of standard charts to identify nutritional risks [24]. Nonetheless, the high prevalence of malnutrition in this study, underscores the heavy burden of both chronic and acute undernutrition in this study population. Stunting, a chronic form of malnutrition, was significantly high [25], plausibly owing to prolonged feeding-related difficulties, such as impaired oral motor function, swallowing problems, and gastroesophageal reflux associated with the condition, which were frequently reported in the study [26]. These challenges require specialised nutrition interventions, such as diet modification for appropriate consistencies and positioning, and, for children with moderate to severe aspiration or malnutrition related to oral-pharyngeal dysphagia, insertion of percutaneous endoscopic gastrotomy (PEG) and jejunostomy tubes, among others, which may be necessary for enteral feeding [27]. Our findings align with similar studies conducted in other low-resource settings in Africa, where stunting contributes to at least 50% of malnutrition in children with CP [28–29]. However, in other LIC settings, comparatively lower prevalence rates have been reported, potentially due to the implementation of community-based rehabilitation and nutrition programs that support feeding and caregiver training [30]. The high rates of undernutrition observed in this study may reflect gaps in structured nutritional and rehabilitative support within Malawi's health system. In particular, the absence of coordinated community-level programs targeting feeding difficulties and nutritional care for children with CP may contribute to these outcomes. These findings highlight the

critical role of contextual factors in shaping nutritional outcomes and reinforce the need for targeted, locally adapted interventions to address modifiable risks in children with CP.

Data from the Global LMIC CP Register, encompassing countries like Bangladesh, Indonesia, Nepal, and Ghana, showed that 72–98% of children with CP experienced undernutrition [3]. In these LMICs, older age, lower maternal education levels, spastic tri/quadriplegia, and severe motor impairments positively influence underweight and stunting among these children [3]. To improve the nutritional outcomes of children with CP in low-resource settings, the implementation of practical nutrition education programs for mothers and caregivers, along with establishment and adherence to management guidelines tailored to the severity of motor impairments; while utilising local resources is warranted [3]. In contrast, children with CP in high-income countries, such as Sweden, exhibit significantly lower rates of malnutrition, largely due to the availability of early feeding interventions and access to comprehensive healthcare services [31]. The disparity highlights the critical role that health system infrastructure and caregiver support play in determining nutritional outcomes. Children's nutrition is influenced by a range of factors, including food availability, healthcare access, and broader social conditions, particularly during the complementary feeding period [32–33].

In the present study, underweight was more common among female children, which contrasts with findings from other studies reporting higher underweight rates in males due to increased energy requirements [34]. These gender differences may be attributed to cultural norms and socio-economic factors that affect access to nutrition and healthcare services [35]. Literature from other rural settings in LMIC, have found higher rates of undernutrition among children with disabilities, with gender disparities attributed to socio-cultural factors, including inequalities in food distribution within households and healthcare-seeking behaviours [35]. These findings underscore the importance of implementing targeted interventions to address nutritional deficiencies and gender disparities in rural areas. In the context of Malawi, these findings highlight the necessity for targeted, community-based interventions that address not only nutritional deficits but also the gender-related barriers affecting children with CP, especially in rural areas.

Feeding difficulties emerged as a significant predictor of both underweight and wasting. This finding aligns with numerous studies that have identified motor dysfunction, swallowing difficulties, and gastrointestinal issues (such as gastroesophageal reflux and constipation) as major contributors to malnutrition in children with CP [1, 4]. Children with CP often struggle with chewing and swallowing, leading to inadequate nutrient intake despite sufficient food availability [36]. Additionally, gastrointestinal complications can further exacerbate malnutrition by impairing nutrient absorption and increasing energy expenditure due to spasticity and involuntary movements [37]. Interventions such as speech and language therapy, specialised feeding techniques, and nutritional supplements mitigate the risk of malnutrition associated with feeding challenges. Furthermore, routine screening for feeding difficulties should be integrated into the standard care of children with CP, particularly in low-resource settings where access to specialised healthcare services is limited.

Wasting was associated with frequent utilisation of nutritional health services. This finding reflects that children who experience nutritional deficits or have multiple comorbidities are more likely to frequently engage with the healthcare system, potentially reflecting late detection and a reactive approach to nutritional care. Although children with CP often attend clinics regularly for physiotherapy, depending on the severity of their condition, these visits may not consistently include nutritional assessments. As such, there is a missed opportunity to integrate nutrition screening and intervention within routine CP management. However, the persistence of high rates of wasting, despite frequent visits, suggests that the services provided may be inadequate in addressing the complex nutritional needs of these children. This finding highlights the importance of strengthening the quality and scope of nutritional care, including routine screening, individualised feeding interventions, and comprehensive caregiver education. Enhancing community-based programs and improving the availability of specialised disability care in rural areas may ensure that children with CP receive timely and effective support [38].

The present study also found that children aged 5 to 18 years were more likely to be wasted than those under five years. One explanation is that younger age is often associated with increased energy requirements as children grow older [33], which are unmet due to persistent feeding difficulties [4]. A further contributor is the health-seeking behaviour of parents of older children, which is often weaker than that of parents of children with younger children with CP [39], thereby providing a window of opportunity for health facilities to identify these children early and offer support and interventions to the primary caregivers. This finding highlights the need for ongoing nutritional support for children with CP as they grow older, particularly during rapid growth and development periods [39].

For children with severe feeding difficulties, PEG is a safe and effective method for long-term enteral nutrition [38]. PEG feeding can improve overall nutritional status, support growth, and reduce the risk of aspiration and other feeding-related complications [40]. Integrating PEG as part of the clinical management plan for children with CP who are at risk of or already experiencing malnutrition may offer a proactive solution to prevent stunting [41].

Study limitations

The results of this study should be interpreted in light of its design, execution and limitations. One limitation was the use of different growth charts, which may have introduced classification bias. While CP-specific growth charts provided a more accurate assessment of children with CP, they may not be universally applicable across different populations. On the other hand, WHO charts may not capture CP-specific growth patterns. To minimise this limitation, both growth charts were used to ensure a more balanced assessment of nutritional status.

Additionally, the cross-sectional study design limits the ability to establish causal relationships between malnutrition and its associated factors. Another potential limitation is the reliance on caregiver-reported feeding difficulties rather than clinical evaluations, which may introduce recall bias.

Furthermore, the present study was conducted at a single site, ZCH, which may not represent the broader population of children with CP in Malawi. Children without access to hospital care may have different nutritional profiles, limiting the generalizability of the findings. Nonetheless, given that the Malawi Health system is similar across the country, the results of this study provide insights into the current nutritional status of children with CP at a typical health facility such as ZCH.

Lastly, the present study did not extensively explore factors such as food security, caregiver burden, cultural feeding practices and stigma, which could have influenced malnutrition among children with CP. The quantitative nature of the study further limited the ability to explore in depth the perspectives and experiences of caregivers and healthcare providers regarding the nutritional challenges they face.

Conclusion

This study highlights the high prevalence of undernutrition among children with CP in Malawi. The findings reveal that malnutrition, manifesting as stunting, wasting, and underweight, is a significant health concern in this vulnerable population. Feeding difficulties, age, and healthcare access were identified as key predictors of malnutrition, underscoring the complex interplay between biological, social, and economic factors. Addressing these challenges requires a multidisciplinary approach and collaboration among healthcare providers, policymakers, and caregivers to ensure that every child with CP receives the support needed for optimal growth, development and good quality of life.

Declarations

Author contributions

RM, TKC and KGHK contributed to the conceptualisation and the study design. RM was the primary author of the manuscript. RM, TKC, KGHK and TC were involved in executing the study. RM, TKC and KGHK were involved in the data analysis. JL, AJM, HC, VM, NK and TC contributed to interpreting the study results and critically reviewed the manuscript. All authors read and approved the final manuscript.

Data availability statement

The data sets used and analysed are available from the corresponding author upon reasonable request.

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Ethics approval and consent to participate.

The study was approved by the Kamuzu University of Health Sciences Research Ethics Committee (KUREC) before the commencement of data collection (P.05/24-0782). Permission to conduct the study was provided by the Hospital Director for ZCH and the Head of the MAP department. The study was performed in accordance with the principles of the Declaration of Helsinki. (2008), Good clinical practice (GCP) guidelines and laws of Malawi. Written informed consent for the study participation was sought from the parents or guardians of all participating children. To ensure privacy and confidentiality, data was released in summary form, and individuals were de-identified. Only the investigators of the study had access to the data. The de-identified records were stored on a password-protected computer. Hard-copy records were stored in a locked filing cabinet.

Consent for publication

Not applicable

Competing interests

The authors declare no competing interests.

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Figures

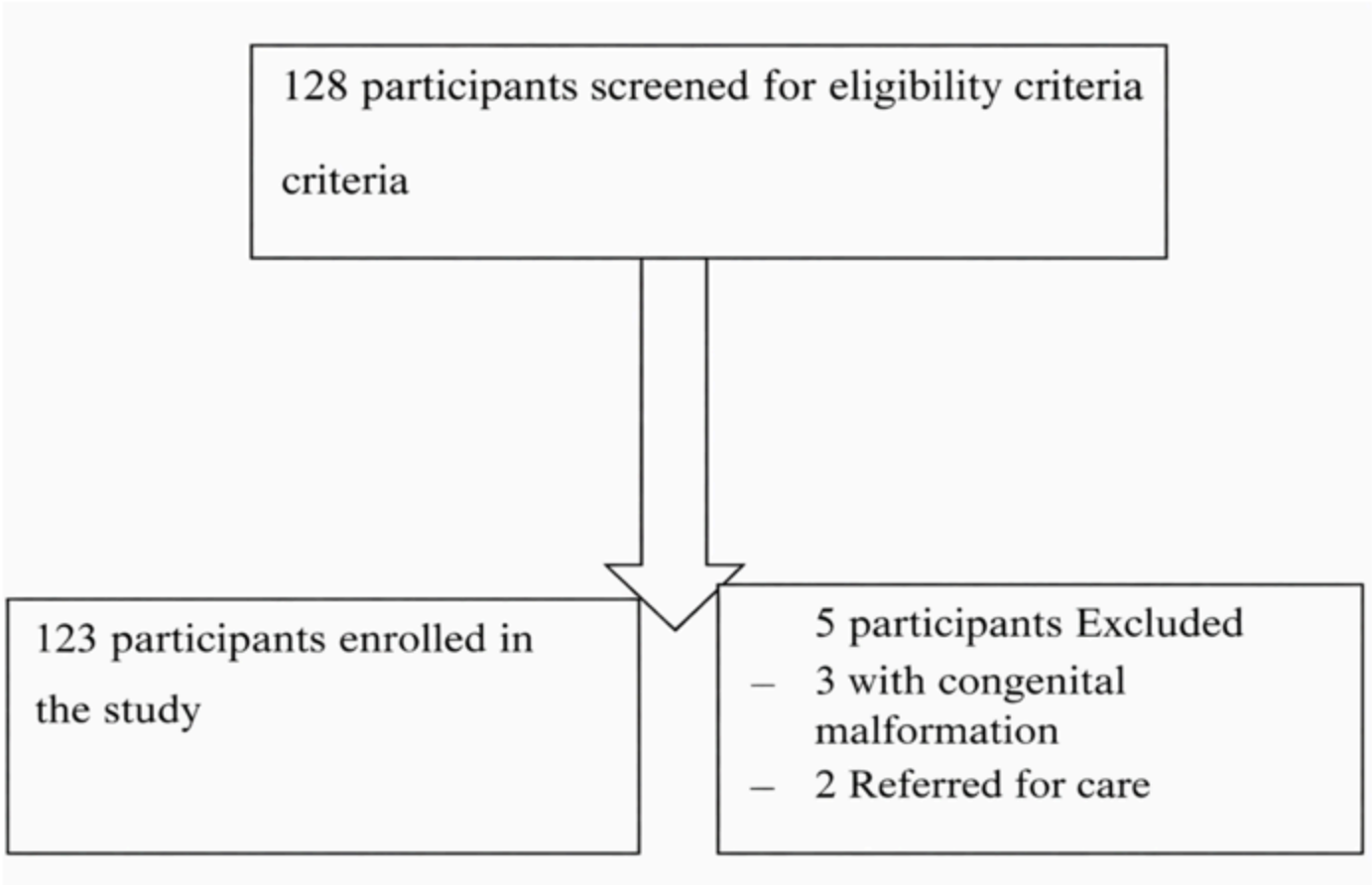


Figure 1

Participant screening, inclusion and exclusion from the study.

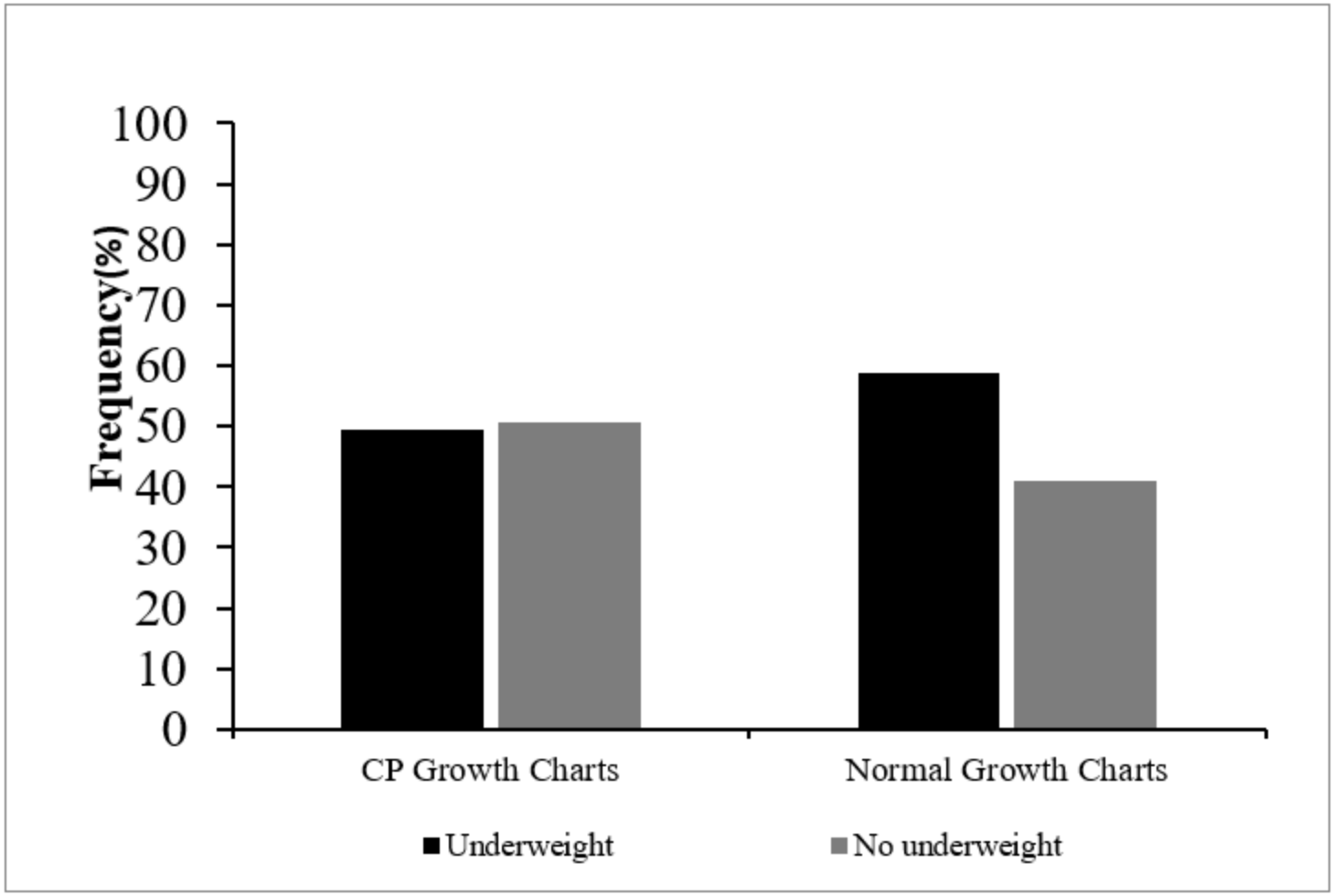


Figure 2

A comparison of the prevalence of Underweight using CP and normal growth charts

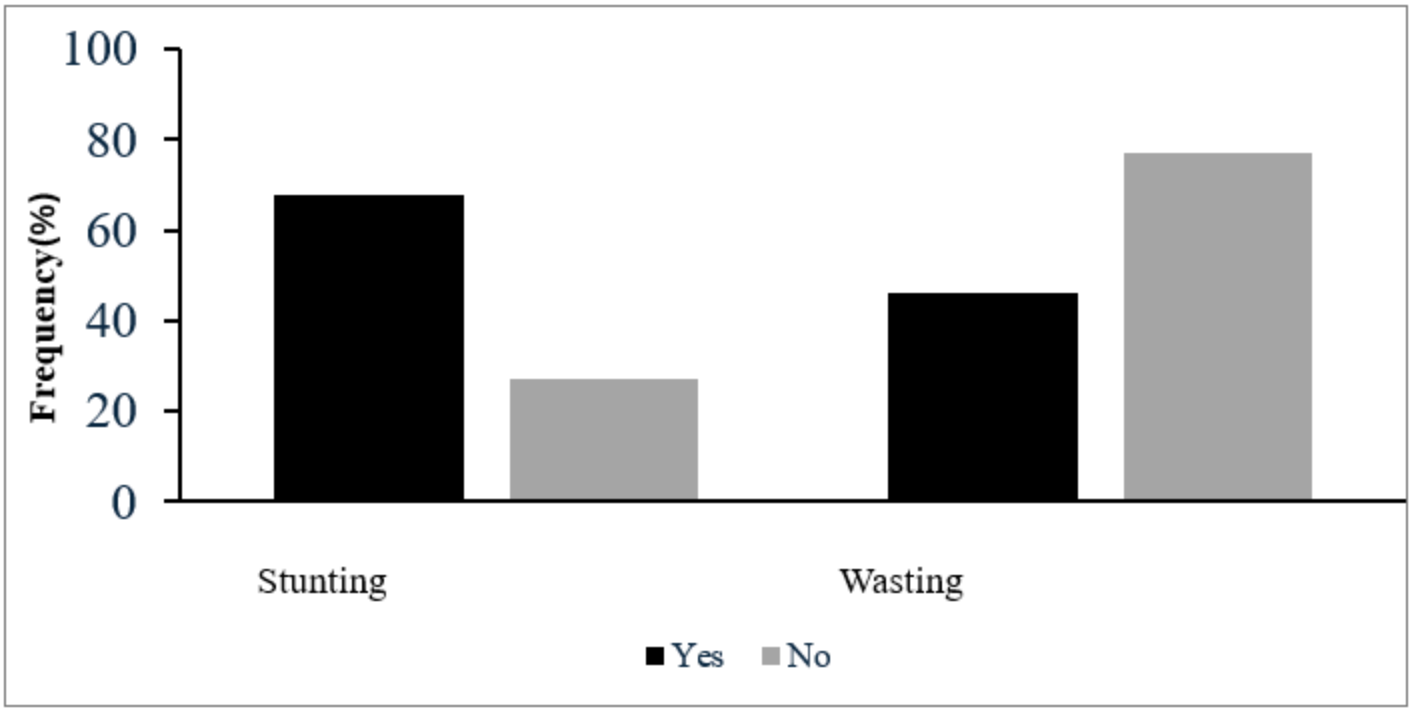


Figure 3

Prevalence of stunting and wasting in children with CP using the normal growth chart

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- DataCollectionForm.pdf