Prevalence and Factors Associated with Malnutrition among Children with Cerebral Palsy Attending a Tertiary Hospital in Ghana

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Abstract

Background: The burden of malnutrition is high in sub-Saharan Africa, and children with Cerebral Palsy (CP) are likely to be affected. Information on the nutritional status of children with CP in Ghana is limited because they are excluded from community surveys of malnutrition due to their specific disabilities. The objectives of this study were to determine the prevalence and factors associated with malnutrition amongst children aged 1 year to 12 years with cerebral palsy at the Department of Child Health, Korle Bu Teaching Hospital (KBTH), Accra, Ghana

Methods: A cross-sectional survey was conducted among 130 registered children aged 1 – 12 years with CP at the Paediatric Neurodevelopmental Clinic of KBTH. Consecutive children who met the criteria were enrolled. Anthropometric measurements, including weight, height, and mid-upper arm circumference, were taken. Z-scores of each anthropometrical measurement were determined using the World Health Organisation (WHO) normal curves. Other variables assessed included feeding difficulties, caregiver socio-demographic characteristics, household characteristics, and dietary history, using a pre-tested questionnaire.

Results: The mean age of participants was 4.0 years ($\pm$ 3.01). The prevalence of wasting, stunting and underweight were 45.4% (95%CI: 36.9% - 54.1%), 39.2% (95% CI: 31.1% – 48.0%), and 54.8% (95% CI: 43.6% – 60.8%), respectively. Wasting was significantly associated with lower carbohydrate food intake (188.8 (155.0) versus 218.6 (137.9), p=0.047 and lower protein intake 28.5 (16.4) versus 36.4 (17.0), p=0.002). The proportion of caregivers with no occupation was higher among children who were stunted.

Conclusion: The prevalence of malnutrition is high among children with cerebral palsy aged 1-12 years who attend the Paediatric Neurodevelopmental Clinic of the Korle-Bu Teaching Hospital, Accra, Ghana. Factors associated with malnutrition include lower carbohydrate and protein intake, and children from poor households.

***Keywords**: Cerebral Palsy, Nutritional Status, Malnutrition, Stunting*

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Introduction

Nutritional status is the state of the human body when food intake is equated to the body's needs as described by the World Health Organisation (WHO) in 2019[1]. In 2020, wasting in children under 5 years was 6.7% globaly and 6% in Africa [2]. Stunting in the African region has declined from 41.5% in 2000 to 30.7% in 2020, although this is still higher than the global average of 22.0%[2]. In Ghana, the prevalence of underweight among children under five years of age has declined from about 16% in 1993 to 11 % in 2014[3], but is still high. Obesity among children is also on the increase globally[4].

Malnutrition among children with cerebral palsy is high, as seen in a study in rural Uganda amongst 67 children with CP aged between 2 and 17 years between 2015 and 2019. 64% of the children were malnourished, with 34% of them showing severe stunting and 38 % of them being severely underweight[5].

Comparatively, these estimates for the African Region are higher than those in the European Region. A multicentre, observational cross-sectional study conducted in 8 European countries between April 2017 and June 2018 among 497 children with CP aged 0-18 years reported that 15% of participants had moderate malnutrition, whilst 21% were severely malnourished. 16% of the participants had severe stunting[6].

Children with CP may, however, have a higher risk of undernutrition due to feeding difficulties[7], associated with factors such as poor swallowing and gastroesophageal reflux. Underweight among children with CP was estimated to be as high as 40% in Italy[8] and about 36% in Nigeria[9]. Children with CP may also have a risk of obesity in later life[10] probably from decreased mobility.

Children with CP are likely to be excluded from national surveys due to factors such as stigmatisation among children with disabilities, leading to their exclusion in social programs such as community health surveys and a low priority given to this special group of children[11], [12]. This study, therefore, sought to determine the nutritional status among children with cerebral palsy and their determinants.

Methodology

Study design

A cross-sectional survey was conducted among children presenting at the Paediatric Neurodevelopmental Clinic of the Korle Bu Teaching Hospital (KBTH) between 1ST September 2016 and 30TH June 2017. KBTH is a referral hospital in the Greater Accra Region of Ghana, but it serves other regions in Ghana where neurological expertise is nonexistent.

Participant identification and selection

Registered children with CP and aged between 1 and 12 years were consecutively enrolled from the KBTH. Informed consent was obtained from caregivers. Children who a) presented with a person not considered as a caregiver, or b) had a chronic disease including cardiac disease, sickle cell disease and retroviral infection or were unregistered at KBTH were excluded from the study.

Clinical assessment

The severity of CP was classified using the Gross Motor Function Classification System[13]. The type of CP was categorised as unilateral or bilateral spastic, dyskinetic, ataxic or mixed.

Weight was taken to the nearest 0.1kg using a calibrated Seca standing or sitting chair for non-ambulatory children. Height was measured using a calibrated Seca stadiometer for children more than 2 years and a calibrated Seca infantometer for children $\leq$ 2 years. For children with deformities or contractures, their tibial length was measured and corrected using a validated standard equation[14], [15]. Mid-upper arm circumference (MUAC) was also measured.

Additional data recorded included feeding difficulties (choking, reduced ability to chew, regurgitation), caregiver socio-demographics (age, education, profession), and household characteristics (wealth index, assets)

Nutritional intake was assessed using three 24-hour dietary recalls administered with a pretested tool. Food types and quantity were converted into weight (grammes) using the Handy Measures tool validated in Ghana 1994[16]. Data were processed using the Microdiet Programme (Downlee Systems Ltd, Edition 2.1, 2005) to generate the average daily food intake compared with the daily recommended allowance for food nutrients per age and sex of participants

Household assets were collected using a closed-ended questionnaire and analysed using principal component analysis that assigned participants into quintiles from poorest to least poor[3].

Sample size

The sample size was calculated using Stata Corp, TX v14, based on prior malnutrition among children with CP in Nigeria (36%) [9]. Assuming 50% prevalence of any malnutrition, 95% confidence and 90% power, a minimum sample size of 106 participants was required. To compensate for refusals and non-response to telephone dietary recall interviews, an additional 24 (22%) participants were included, leading to a final sample size of 130[17].

Data management and analysis

Completed questionnaires were double-entered into a Microsoft Access database, checked for accuracy and analysed with Stata v14. Anthropometric measurements were converted into z-scores using WHO growth standards [18]. The following classifications were applied:

Wasting: weight for height z-score (WHZ) between -3 and -2 and < - 3 for moderate and severe, respectively, for all ages; Among children < 5 years, mid upper arm circumference (MUAC) between 11.5 – 12.5cm for moderate and <11.5cm for severe wasting.

Underweight: weight for age z-scores (WAZ) between -3 and -2 for moderate and < - 3 for severe underweight.

Stunting: height for age z-scores (HAZ) between -3 and -2 for moderate and < - 3 for severe stunting. Overweight: WHZ > +2 for children < 5 years and Body Mass Index (BMI) for age z-score > +1 for >5 – 12 years. Obesity: WHZ > +3 for children < 5 years, and BMI for age > +2 for >5 – 12 years. A composite score for malnutrition was created using wasting, underweight or stunting.

Groups were compared using the chi-square test or Fisher's exact test for categorical variables and t-test or Wilcoxon rank-sum test for continuous variables, depending on distribution. Univariate and multivariate logistic regression models were used to explore the factors associated with wasting, underweight and stunting. Adjusted odds ratios (aORs) with 95% confidence intervals (CI) are reported with significance set at $p<0.05$.

Ethical considerations

The Institutional Review Board of Korle Bu Teaching Hospital reviewed and approved the protocol (Ref: KBTH-IRB/00039/2016). Written informed consent was obtained from caregivers. All data collected was kept confidential. All participants with any abnormalities such as malnutrition, were referred appropriately for further care after discussion with the clinical team at the clinic.

Results

Characteristics of participants

A total of 130 children with Cerebral Palsy were enrolled, all of whose caregivers consented to participate. Proportion of study participants less than 5 years and 5 – 11 years were 63.9% (n=83) and 36.1% (n=47), respectively (Table 1). Among participants, the mean age was 3.95 (3.01), 60.8% were male, and 57 (43.9%) of their caregivers had no form of occupation. The commonest types of CP were bilateral spastic (87/130, 66.9%) and unilateral spastic (12.3%). Fifty-four (41.6%) participants had the most severe disability (GMFC level 5) (Figure 1).

Wasting

The prevalence of wasting was 45.4% (95%CI: 36.9% - 54.1%). Proportion of moderate and severe wasting was 19.2% and 26.2%, respectively (Table 2).

Factors associated with wasting

The distribution of caregivers' education and marital status was similar among children who were either wasted or not wasted (supplementary Table 1).

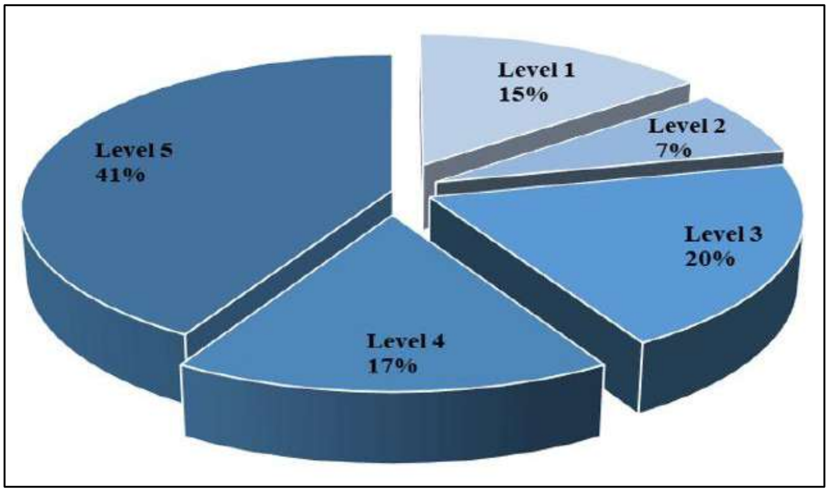

Figure 1
Characteristics of Cerebral Palsy

Table 1
Characteristics of 130 Study Participants and Caregivers

Variable		n	%
Child characteristics			
Age group	Less than 5years	83	63.9
	5-11 years	47	36.1
	Gender		
	Male	79	60.8
	Female	51	39.2
Primary caregiver characteristics			
Relationship to child	Mother	113	86.9
	Father	1	0.8
	GrandMother	13	10.0
	Aunt	3	2.3
Education	None	8	6.2
	Primary school	9	6.9
	Middle/JHS	49	37.7
	Technical/Commercial/SHS	35	26.9
	Post-middle training	3	2.3
	Post-secondary training	6	4.6
	University	20	15.4
Marital status	Married/ Cohabiting	107	82.3
	Single	23	17.7
Religion	Christians	98	75.4
	Muslims	16	12.3
	Others	16	12.3
Occupation	Professional	15	11.5
	Other	58	44.6
	No Occupation	57	43.9
Wealth index	Poorest	26	20.0
	More poor	26	20.0
	Poor	26	20.0
	Less poor	26	20.0
	Least poor	26	20.0

Proportion of caregivers with no occupation was 45.8% (n=27) among children who were wasted compared to 42.3% (n=30) among children who were not wasted (p=0.341). The mean estimated carbohydrate food intake among wasted children was significantly lower than that among children who were not wasted (188.8 (155.0) vs 218.6 (137.9), p= 0.047). Similarly, the estimated energy intake (997.1 (705.2) vs. 1193.2 (647.0), p=0.013) and protein (28.5 (16.4) vs. 36.4 (17.0), p=0.002) intake were significantly lower among children who were wasted compared to children who were not wasted.

Children with CP born to the least poor households were significantly less likely to be wasted compared to children from the poorest household (aOR 0.23, 95% CI 0.06 - 0.85, p=0.028). Demographic characteristics such as maternal age, caregiver marital status, and child's age were not significantly associated with wasting.

Table 2
Prevalence of Undernutrition among Participants

		≤ 5 years (N=83)	6 – 12 years (N=47)	Total (130)
Wasting	No wasting	40 (48.2)	31(66.0)	71 (54.6)
	Moderate wasting	19 (22.9)	6 (12.8)	25 (19.2)
	Severe wasting	24 (28.9)	10 (21.3)	34 (26.2)
Wasting	Normal (MUAC >12.5cm)	71 (85.5)	-	
	Moderate wasting (MUAC 11.5-12.5cm)	4 (4.8)	-	
	Severe wasting (MUAC<11.5cm)	8 (9.7)	-	
Underweight[A]	No underweight	34 (41.0)	22 (53.6)	56 (45.1)
	Moderate underweight	21 (25.3)	7 (17.1)	28 (22.6)
	Severe underweight	28 (33.7)	12 (29.3)	40 (32.3)
Stunting	Not stunted	51 (61.5)	28 (59.6)	79 (60.8)
	Moderate	19 (22.9)	7 (14.9)	26 (20.0)
	Severe	13 (15.7)	12 (25.5)	25 (19.2)

A: Data for 6 participants aged >10 years were excluded because the WHO WAZ z-score is indicated for only children ≤10 years.

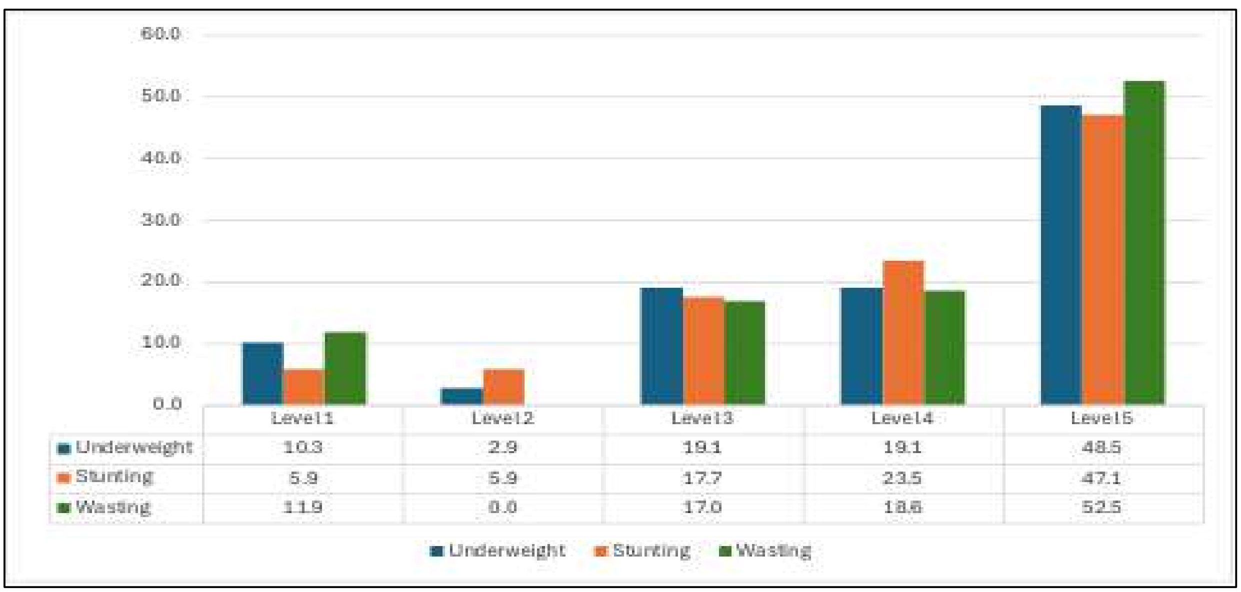

Figure 2
Proportion of underweight, stunting and wasting by severity of CP

Prevalence of wasting (MUAC<12.5cm) among children with cerebral palsy < 5 years

The prevalence of wasting, defined as MUAC <12.5 cm, among children with CP less than 5 years was 15.5% (12/83, 95% CI 9.34 – 24.78). Eight children with CP were severely wasted (MUAC<11.5cm) (Table 2).

Underweight

The prevalence of underweight was 54.8% (68/124, 95% CI: 43.6% – 60.8%), and that of severe underweight was 32.3% (Table 2). Among the 68 underweight participants, thirty-three (48.5%) had the severest form of CP (Level 5) (Figure 2).

Factors associated with underweight

A greater proportion of children who were underweight had caregivers with no/low education compared to those whose caregivers had higher education (86.8% versus 67.9%, p = 0.011). Underweight children with CP were 68% less likely to have caregivers who were educated (aOR 0.32 (95% CI 0.13 - 0.79, p=0.013), but this was not observed in the multivariate analysis (aOR 0.58 (95% CI 0.17 – 2.01, p=0.387). Children who were from poor households were more likely to be underweight (overall p=0.003). Children with Level 3 - 5 CP severity were more likely to be underweight in the univariate analysis (2.86 (95%CI 1.16 - 7.05), p=0.023), but there was weak evidence to support this association in the multivariate analysis (aOR 95% CI 2.76 (0.87 - 8.72), p=0.084).

Stunting

The prevalence of stunting was 39.2% (51/130) (95% CI: 31.1% – 48.0%). The proportion of moderate and severe stunting was 20.0% and 19.2%, respectively (Table 2).

Factors associated with stunting

The proportion of caregivers with no occupation was higher among children who were stunted (25/51, 49.0%) compared to children who were not stunted (32/79, 40.5%), but this difference was not statistically significant (p=0.305) (Table 3).

The mean of carbohydrate food intake among stunted children was 202.3g (137.2) compared to children who were not stunted, 206.8 (152.4), p=0.953.

Children with level 4 or 5 severity were more likely to be stunted in the univariate analysis (2.89 (95%CI 1.08 - 7.74), p=0.034) but not statistically significant in the multivariate analysis (p= 0.356).

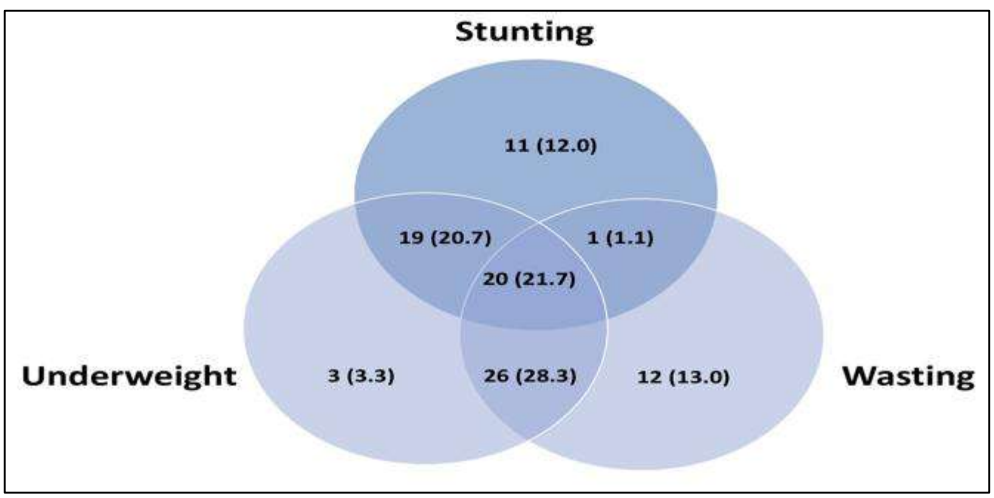

Figure 3
Prevalence of Different Combinations of Undernutrition. N for Venn diagram = 92 children who were undernourished and excludes 38 children who were not undernourished. Data presented as n (%). Wasting was defined using WHZ scores for children < 5 years and BMI for age 5- 12 years.

Demographic characteristics such as maternal age, caregiver marital status, and child's age were not significantly associated with stunting.

Stunting, wasting or underweight

The prevalence of either stunting, wasting or underweight was 70.8% (95% CI: 62.3% - 78.0%). Twenty (21.7%) of all the 92 participants who were undernourished were stunted, underweight and wasted (Figure 3). Among the 92 undernourished participants, nineteen (20.7%) were stunted and underweight, 1.1%(1/92) stunted and wasted and 28.3% (26/92) were underweight and wasted.

Overweight or obesity.

The prevalence of overweight alone was 4.62% (6/130, 95% CI: 0.96% - 8.27%) or obesity alone was 4.62% (6/130, 95% CI: 0.96% - 8.27%). The prevalence of overweight and obesity was 9.2% (12/130, 95% CI: 4.2% - 14.3%).

Discussion

This study sought to determine the prevalence of malnutrition among children with CP, a population with limited information on nutritional status. The findings show a high prevalence of wasting, stunting and underweight, especially among children with CP from poorer households. These results underscore the nutritional vulnerability of children with CP and highlight the need for targeted interventions.

The prevalence of undernutrition found in this study was lower than that of Polack et. al., who also determined the nutritional status of children with CP in Ghana [19]. In their study, the prevalence of malnutrition was higher among 54 children <5 years; wasting was 58%, and the prevalence of stunting and underweight were 54% and 65%, respectively. Several reasons may explain the differences: this study included regular attendants to a tertiary level care in an urban area, and are likely to have received high-level multidisciplinary specialist care, such as dietary rehabilitation by nutritionists who are accessible within the hospital. Secondly, differences in socioeconomic status in rural and urban populations may have played a role. National survey analysis in Ghana showed that children living in the lowest wealth quintile and in rural households are at a higher risk of undernutrition [20]. and have poor access to health care [21]. Thirdly, the difference in age distribution among the two study populations could account for the differences observed. The Polack study focused on children with CP less than 5 years who are at a higher risk of undernutrition in the general population in Ghana and other African countries [22,23, 24,25].

MUAC < 12.5cm was used as an indicator for wasting in addition to weight for height < - 2 z-score to ensure comparability between this study and other studies done in other locations. It was expected that the prevalence of wasting using MUAC as an indicator would be as high as that of wasting measured by weight for height z-scores, since both measures are indicators of body mass. However, wasting by weight for height for participants less than 5 years was 51.8%, against wasting by MUAC, which was 15%. This observation of lower prevalence of wasting measured by MUAC in a population with a high prevalence of wasting as measured by weight for height z-scores has been previously reported in children with CP in other studies by Kakooza-Mwesige et. al. in Uganda [23, 26]. Indeed, Briend et. al. and Chitekwe et. al. in Nigeria (2009) have argued that MUAC could be used in place of weight measurement as it is much cheaper and easier to assess within the community or in health facilities [27, 28]. This argument may however, not hold for children with CP, since there may be muscle build-up from frequent use of the arms for motility among children with CP, as may be the case in this study.

The prevalence of wasting, stunting and underweight among children with CP in this study was approximately 4 times that observed among children < 5years as per the Ghana Demographic and Health Survey in 2014, though the age group for this study was wider. The phenomenon of a high prevalence of undernutrition among children with CP compared to children without CP was found by Kuper et. al. in 2013 in a case-control study among Kenyan children with moderate to severe disabilities, the majority of whom were children with CP. In their study, children with disabilities were about 2 - 3 times more likely to be wasted, stunted or underweight compared to their siblings and neighbouring controls [29]. This is likely to be due to poor intake of food from feeding difficulties such as reduced ability to chew and swallowing difficulties associated with children with disabilities, as demonstrated by Caselli et. al. (2017) [30].

In this study, the prevalence of severe acute malnutrition was high (26.2%) and comparable to another study by Adamu et. al. among children with CP in Kano, Nigeria (31%) [31]. The prevalence of SAM is also about twenty times that found among children <5 years in the general population from the 2014 Ghana Demographic Health Survey [3]. This makes children with CP a legitimate target for focused interventions aimed at preventing malnutrition

In this study, factors such as a poor wealth index were associated with undernutrition. Poor wealth was adversely associated with undernutrition in the general population, as found by Novignon et. al. (2015) in analysing data from the Ghana Multiple Indicator Cluster Survey [20]. Children with CP from poor households were more likely to be undernourished in this study. This is likely as caregivers in the poor social class are less likely to have money to spend on nutritious and well-balanced meals, as postulated by Akombi et. al. (2017) in their review of undernutrition in sub-Saharan Africa [32]. The income level of caregivers was, however, not significantly associated with malnutrition among children with CP. On the other hand, the wealth index was found to be significantly associated with wasting and underweight. The wealth index in this study was calculated based on household assets that may not necessarily be directly owned by a caregiver, as compared to the income, which is directly owned by the caregiver. The inconsistent findings in the association of malnutrition with wealth, as calculated based on household assets and that of caregiver income, were therefore not unexpected.

The severity of CP was found to be associated with undernutrition in this study. This finding is similar to that by Kuper et. al. (2015) in their case-control study among 311 Kenyan children aged 6 months to 10 years. In their study, children with moderate to severe disability were about two times more likely to be wasted [29]. This observation is similar among children with CP as found by Jahan et. al. (2016) in Bangladesh [25]. The reason for a higher prevalence of undernutrition among severe forms of CP may be a result of a reduction in nutrient intake as a result of feeding difficulties, such as oropharyngeal dysphagia. A study done by Caselli et al. (2017) found that the prevalence of undernutrition among children in Brazil with tetraparesis CP who were fed orally was 24% higher than those who were fed via gastrostomy [30] and this conclusion was attributed to increased intake with the use of the gastrostomy tube.

The following limitations are acknowledged. The study is unable to establish causal relationships with the factors examined that are associated with malnutrition among CP children. For instance, it is unlikely to establish whether CP children have poor feeding that leads to malnutrition or vice versa. Recall biases could be associated with the responses obtained from the study participants with regard to the dietary recall. This recall bias may underestimate the impact of socio-economic levels on malnutrition among CP children.

Conclusion

The prevalence of undernutrition among children with CP attending the Paediatric Neurodevelopmental Clinic at KBTH is high. It is recommended that anthropometric measurements be done for all children with CP regularly on their visits to the hospital for early intervention to prevent complications of malnutrition.

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Authors' contribution

- Study conception and design: A Asante, E Badoe, KP Asante, G Obeng Adjei
- Data collection: A Asante, M Johnson
- Data analysis: A. Asante, F Oppong, KP Asante
- Interpretation of results: A Asante, F Oppong, KP Asante, E Badoe, G Obeng Adjei, M Johnson
- First draft manuscript preparation: A Asante, F Oppong
- Review and editing of manuscript: A Asante, F Oppong, KP Asante, E Badoe, G Obeng Adjei, M Johnson
- All authors reviewed the results and approved the final version of the manuscript.

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Availability of data and materials. The data will be made available upon reasonable request to the corresponding authors.

Competing interest. The authors declare no conflicts of interest.

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Supplementary Table 1

Sociodemographic and Nutritional Characteristics of Study Participants

		Wasting^A		Underweight^A		Stunting^A	
Variable		Yes n=59)	No (n=71)	Yes(n=68)	No (n=56)	Yes(N=51)	No N=79)
Caregiver's income (GHC); mean (SD)		259.8 (482.1)	596.3(1849.4)	253.0(499.2)	691.9(2056.1)	318.6 (573.4)	524.3(1749.7)
PHQ-9; mean (SD)*		6.9 (4.6)	6.2 (4.6)	7.2 (4.6)	5.7 (4.6)	7.0 (4.0)	6.2 (4.9)
Caregiver's Education	No/lower education	46 (78.0)	55 (77.5)	59 (86.8)	38 (67.9)	42 (82.4)	59 (74.7)
	Higher Education	13 (22.0)	16 (22.5)	9 (13.2)	18 (32.1)	9 (17.6)	20 (25.3)
Caregiver Marital status	Married/ Cohabiting	48 (81.4)	59 (83.1)	56 (82.3)	45 (80.4)	41 (80.4)	66 (83.5)
	Single	11 (18.6)	12 (16.9)	12 (17.7)	11 (19.6)	10 (19.6)	13 (16.5)
Caregiver occupation	Professional	9 (15.2)	6 (8.4)	4 (5.9)	10 (17.9)	4 (7.8)	11 (13.9)
	Other	23 (39.0)	35 (49.3)	32 (47.1)	24 (42.8)	22 (43.2)	36 (45.6)
	No Occupation	27 (45.8)	30 (42.3)	32 (47.0)	22 (39.3)	25 (49.0)	32 (40.5)
Wealth Index	Poorest	17 (28.7)	9 (12.7)	20 (29.4)	4 (7.1)	14 (27.4)	12 (15.2)
	More poor	14 (23.7)	12 (16.9)	17 (25.0)	8 (14.3)	11 (21.6)	15 (19.0)
	Poor	12 (20.3)	14 (19.7)	10 (14.7)	15 (26.8)	9 (17.7)	17 (21.5)
	Less poor	8 (13.6)	18 (25.4)	10 (14.7)	14 (25.0)	10 (19.6)	16 (20.2)
	Least poor	8 (13.7)	18 (25.4)	11 (16.2)	15 (26.8)	7 (13.7)	19 (24.1)
Child's Age; mean (SD)		3.3 (2.9)	4.5 (3.0)	3.4 (2.7)	3.9 (2.6)	3.9 (3.0)	3.9 (3.0)
Gender	Male	36 (61.02)	43 (60.56)	40 (58.82)	33 (58.93)	28 (54.9)	51 (64.6)
	Female	23 (38.98)	28 (39.44)	28 (41.18)	23 (41.07)	23 (45.1)	28 (35.4)
Feeding problem score; mean (SD)		5.7 (2.7)	4.0 (2.9)	5.4 (2.8)	4.2 (2.9)	5.4 (2.6)	4.4 (3.1)*
Child's Nutritional intake; mean**(**SD**)**	Carbohydrate(g)	188.8(155.0)	218.6(137.9)	190.7(129.3)	220.7 (170.1)	202.3(137.2)	206.8 (152.4)
	Energy (kcal)	997.1 (705.2)	1193.2 (647.0)	1029.2(618.6)	1173.9 (765.5)	1096.2(665.0)	1109.4(691.3)
	Protein	28.5 (16.4)	36.4 (17.0)	30.4 (16.4)	35.2 (18.2)	31.3 (18.1)	33.9 (16.6)
	Iron	13.6 (10.3)	16.3 (13.6)	15.0 (12.6)	15.2 (12.4)	15.8 (13.3)	14.6 (11.6)
Severity of CP	Low (Level 1 &2)	7 (11.9)	21 (29.6)	9 (13.2)	17 (30.4)	6 (11.8)	22 (27.8)*
	High (level 3 –5)	52 (88.1)	50 (70.4)	59 (86.8)	39 (69.6)	45 (88.2)	57 (72.3)
Spillage during self-feed	Minimum	5 (8.5)	16 (22.5)	7 (10.3)	12 (21.4)	6 (11.8)	15 (19.0)
	Moderate	2 (3.4)	4 (5.6)	3 (4.4)	1 (1.8)	3 (5.9)	3 (3.8)
	High	5 (8.5)	9 (12.7)	8 (11.8)	6 (10.7)	6 (11.8)	8 (10.1)
	No self feed	47 (79.6)	42 (59.2)	50 (73.5)	37 (66.1)	36 (70.5)	53 (67.1)

A: Includes moderate to severe outcomes: Unless stated, data are reported as n (%). PHQ9*: Patient Health Questionnaire. Chi-squared/Fisher's exact test (**) was used for differences in proportions, while the Wilcoxon rank-sum test was used for differences in mean