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Swallowing difficulty and its association with nutritional risk among stroke patients in a primary healthcare facility

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Abstract

Background: Swallowing difficulty is common in stroke patients and is associated with prolonged inadequate food intake. This eventually leads to malnutrition and dehydration and contributes appreciably to stroke complications and mortality rates. The associated nutritional risk is often undetermined.

Objective: To determine the prevalence of swallowing difficulty among stroke patients and its association with their dietary intake and nutritional risk.

Methods: The study design was cross-sectional, involving 57 stroke inpatients recruited from the Polyclinic, Korle-Bu Teaching Hospital. Swallowing difficulty and dietary intake were assessed using the water swallowing test and 24-hour recall interviews respectively. Nutritional risk was determined using the Nutritional Risk Screening tool (NRS-2002). Data were analysed using SPSS version 21.0 at a 95% confidence interval. Significance was set at $p < 0.05$.

Results: Mean age was 64.3 ± 15.9 years. The majority (57.9%) had swallowing difficulty with an 8-fold higher nutritional risk compared to those without swallowing difficulty [$R^2 = 0.754$; OR= 8.40; $p = 0.010$ (CI = 2.177 - 32.128)] after adjusting for age, gender, education and occupation. Median daily energy intake was significantly lower in the former [628kcal; (483-1003)] compared to the latter [(1,017 kcal; 600 - 1586); $p = 0.025$].

Conclusion: More than half of the participants had swallowing difficulty with a significantly higher nutritional risk and lower daily energy intake. Early routine assessment of nutritional risk, followed with timely appropriate interventions, is strongly advocated as part of standard operating procedures for stroke management in primary care to reduce stroke complications and mortality.

Keywords: stroke, swallowing difficulty, malnutrition, nutritional risk, dietary intake

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INTRODUCTION

Stroke is the second leading cause of death and the third leading cause of death and disability combined globally, especially in low-and middle-income countries (LMIC) [1,2]. Over 80% of cases occur in LMIC [3]. In these countries, resources for stroke management are also minimal, resulting in increased mortality and disability-adjusted life years [2,4]. Ghana is experiencing a rise in the prevalence of stroke as it is recorded to have contributed to 9.1% of all medical adult admissions and 13.2% of all medical adult deaths at Komfo Anokye Teaching Hospital from January 2006 to December 2007 [5]. It is currently among the top ten causes of hospital attendance and admissions at the Korle-Bu Teaching Hospital, the nation's biggest tertiary health facility [6]. Common symptoms of stroke include paralysis of the face, arm or leg, difficulty talking and walking, impaired eyesight and difficulty swallowing [7,8]. The estimated

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prevalence of swallowing difficulty in acute stroke (between 28% and 65%) [9] and (between 30% to 50%), with a subsequent drop to 10% after six months, has been reported [10]. It is associated with aspiration pneumonia, - malnutrition, dehydration and extended hospital stay [11]. These contribute to the morbidity and mortality associated with the disease. While the determining factors of malnutrition among stroke patients are complex, research suggests the significant role played by swallowing difficulty irrespective of the type of stroke. This is attributable to the long periods of inadequate dietary intake during inpatient care and increased length of hospital stay [12]. Malnutrition prevalence of between 8.2% and 20% in the acute phase of a stroke at early admission and 6.1% and 62% at the rehabilitation stage has been reported [12,13]. The wide ranges have been attributed to different timing of assessment, stroke type, comorbid medical conditions, stroke complications, and, most importantly, nutrition assessment methods [13,14]. Malnutrition in stroke is associated with poorer functional outcomes, aggravated disability, and increased length of hospital stays. It makes patients susceptible to most infections as a result of immunodeficiency [15], thus increasing mortality rates at 3 – 6 months after stroke [13]. Reduced serum levels of vitamins A, C and E are associated with functional decline, larger cerebral infarctions, and higher mortality rates, most likely due to increased oxidative stress in the acute period [13].

Swallowing difficulty is not usually assessed in the usual care of stroke patients in primary healthcare facilities [16]. There is scanty information on the prevalence of swallowing difficulty among stroke patients in Ghana. The extent of nutritional risk it presents and the potential need for early nutrition support remains to be investigated and documented. This knowledge gap provided the rationale for carrying out this study. The evidence is needed to inform the inclusion of early assessment of swallowing difficulty and nutritional risk of stroke patients in the standard operating practice of stroke management in primary health care facilities. The study, therefore, aimed to determine the prevalence of swallowing difficulty among stroke patients at the Korle-Bu Polyclinic (KBPC) Accra, Ghana, and its effect on their dietary intake and nutritional risk.

MATERIALS AND METHODS

Study design and sites

The study design was cross-sectional. It was carried out at the Korle-Bu Polyclinic, a 42-bed facility originally established primarily to offer primary health care to the catchment area. The facility has grown over the years to cater for the wider Greater Accra Region under the Korle-Bu Teaching Hospital, the nation's first tertiary health facility. It is accredited by both the Ghana College of Physicians and Surgeons and the West African College of Physicians and Surgeons to train Family Physicians. The skill mix in the facility has thus been diversified over time, and the quality of care given to patients has been upgraded. The cadre of care providers includes Specialist Family Physicians and Consultants in addition to General Practitioners. Stroke is one of the commonest conditions treated at this hospital, and it is the leading cause of death in the facility [6].

Sample size and sampling technique

Study participants were inpatients newly diagnosed with stroke and being managed at the study site at the time of data collection, who consented to participate. Stroke diagnosis was made on clinical grounds (history and physical examination) with or without computed tomography (CT) findings. Family physicians were responsible for diagnosing all cases. Substantial evidence supports stroke diagnosis based on history and physical examination by trained physicians, especially in resource-deprived settings, with up to 92% sensitivity reported [8]. Common symptoms that aid in diagnosis may include acute onset, hemiparesis/hemiplegia (unilateral weakness), speech disturbance, facial paresis, headaches and dysphasia [8]. Data were collected between January and June 2018. The estimated sample size (Ne) was determined using the equation for descriptive studies to measure a characteristic in terms of a proportion as described by Eng [17]. The prevalence of swallowing difficulty among stroke patients (65%) reported by Cohen et al. [9] was used. The correction was done for a finite population to achieve a sample size of 57 because the estimated sample size (1398) exceeded 5% of the population size of approximately ten newly diagnosed stroke patients presenting to the study site monthly.

$$Ne = \frac{4(Z)^2 P(1-P)}{D^2}$$

Ne = estimated sample size

P = prevalence of swallowing difficulty among stroke patients (65%) reported by Cohen et al. [9].

Z= 1.96

D = 5% (margin of error)

$$Ne = \frac{4(1.96)^2 0.65(1-0.65)}{(0.05)^2} = \frac{3.496}{0.0025} = 1398$$

Nt = total population (10 new cases per month for six months = 60)

Nc= finite population correction factor

$$Nc = \frac{Ne(Nt)}{Ne+(Nt-1)} = \frac{1398\ x\ 60}{1398+(60-1)} = 57.6$$

All consecutive eligible patients were invited to participate in the study. A total of 57 stroke inpatients consented and were recruited into the study.

Data Collection

A validated semi-structured questionnaire was administered to obtain sociodemographic information. The

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questionnaire was couched from the first step of the generic WHOSTEPS instrument for non-communicable disease risk assessment [18] with mild modification. Brief clinical information pertaining to the diagnosis of stroke was also obtained from the patient's hospital records. Swallowing difficulty, dietary intake, nutritional risk and nutritional status were assessed.

Determination of swallowing difficulty

Swallowing difficulty was assessed within 48 hours of admission by a trained nurse. The water swallowing test described by Horiguchi & Suzuki [19] was used. Signs noted included water being retained in the mouth, choking, coughing, drooling, aspiration and swallowing longer than 30 seconds. Difficulty in swallowing was recorded when the patient was unable to swallow successfully within 30 seconds. When the patient was able to swallow successfully without signs of swallowing difficulty, longer than 30 seconds, up to two more attempts were made. During the repeated attempt, any evidence of swallowing difficulty, as earlier mentioned or swallowing successfully for longer than 30 seconds was recorded as swallowing difficulty. The assessment was discontinued upon signs of difficulty in swallowing.

Dietary intake assessment

Twenty-four-hour recall interviews (for two consecutive days) were used to determine the patient's dietary intake by a registered dietician. The patients and their caregivers were asked to mention and describe all foods, snacks and beverages the patient consumed the previous day. Assisted with handy household measures and food models; they estimated the amount of each food, snack and beverage consumed, which was documented. The interview was repeated the next day to obtain the food, snacks and beverage intake for the previous day (day two), which was also documented. For each item consumed, the food weight, energy, macronutrient and fibre content were determined using ESHA Food Processor software (version 6.02) and nutrient composition tables of the Food Research Institute of Ghana [20]. Total energy, macronutrient and fibre intakes for each day were determined, and the mean daily intakes were computed.

Nutritional risk assessment

Nutritional risk was assessed using the Nutritional Risk Screening (NRS-2002) tool [21]. Patients were initially screened based on body mass index (BMI), weight loss within the last three months, reduced food intake and severity of illness. When the response to any of these questions was yes, the final screening continued, assessing nutritional risk based on weight loss, dietary intake, and disease severity. Patients with mild, moderate and severe strokes, as described by the tool, scored 1, 2 and 3, respectively. An additional score of 1 was added for patients aged 70 and above. A total score of 3 or more suggested high nutritional risk, 2 was a moderate risk, and a score of 1 was a mild nutritional risk.

Estimation of nutritional status

Nutritional status was assessed using waist circumference (WC) measured to the nearest 0.1cm following standard protocol. [22]. A trained nurse took measurements at the same time daily for the first three days of admission to determine the mean. WHO, 2008 [22] was used as reference data. The choice of WC as an indicator of nutritional status was due to its strong correlation with BMI and because it was anticipated that some patients could not stand upright.

Data analysis

Microsoft EXCEL and SPSS version 21 were used. Analyses were done at a 95% confidence interval. Categorical data were analysed using Pearson's Chi-Square and Fisher Exact Test. Means ± SD and Students' T-test were used to analyse and compare means of normally distributed continuous data, respectively. Medians with interquartile ranges (25th to 75th percentiles) and Mann Whitney U-Test were used to analyse and compare skewed data. Significance was set at $P \leq 0.05$. The relationship between swallowing difficulty and nutritional risk was determined using multiple logistic regression analysis, and nutritional risk was the dependent variable.

RESULTS

Table 1 describes the sociodemographic profile of the 57 study participants. Their mean age was 64.3 ± 15.9 years. Females formed the majority (54.4%).

Table 1: Background characteristics of study participants.

Variables	Total
Mean Age (years)	64.3 ± 15.9
Number of participants (%)	57 (100.0)
Males	26 (45.6)
Females	31 (54.4)
Age categories (%)	
30-39	6 (10.5)
40-49	2 (3.5)
50-59	12 (21.1)
≥ 60	37 (64.9)
Marital Status (%)	
Single	6 (10.5)
Married	22 (38.6)
Divorced	13 (22.8)
Separated	8 (14.0)
Widowed	8 (14.0)
Employment Status (%)	
Retired	37 (64.9)
Driver/Artisan/Clerical	8 (14.0)
Tradesperson	12 (21.1)
Highest Education (%)	
Primary	9 (15.8)
Secondary	21 (36.8)
Tertiary	27 (47.4)

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Table 2 reports the clinical information and nutritional status of study participants. Over half of the participants had swallowing difficulty. Hypertension, diabetes and speech impairment were also recorded.

Table 2: Clinical characteristics and nutritional status of participants.

Variable	Frequency (%) n = 57
Stroke Diagnosis	
Undifferentiated	36 (63.2)
Haemorrhagic stroke	4 (7.0)
Ischaemic stroke	17 (29.8)
Hypertension	
Yes	49 (86.0)
No	8 (14.0)
Diabetes	
Yes	27 (47.4)
No	30 (52.6)
Swallowing difficulty	
Present	33 (57.9)
Absent	24 (42.1)
Hemiplegia	
Left side	8 (14.1)
Right side	19 (33.3)
Both sides	2 (3.5)
None	26 (45.6)
Record not available	2 (3.5)
Speech Impairment	
Yes	6 (10.5)
No	49 (86.0)
Record not available	2 (3.5)
Glasgow coma score	
Sever unconsciousness	17 (29.8)
Moderate unconsciousness	8 (14.0)
Mild unconsciousness	4 (7.0)
Conscious	28 (49.2)
Waist circumference	
Normal	20 (37.7)
Abdominal obesity	33 (62.3)

Table 3 shows nutritional status, nutritional risk and nutrient intake with and without swallowing difficulty. A significant majority of participants with swallowing difficulty had high nutritional risk.

Table 4 reports the relationship between nutritional risk and swallowing difficulty in a multiple logistic regression analysis. Swallowing difficulty remained an independent predictor of nutritional risk among stroke patients after adjusting for age, gender, education and occupation. Stroke patients with swallowing difficulty had an 8-fold higher nutritional risk than those without.

DISCUSSION

The mean age of study participants was 64.3 ± 15.9 years. A previous study reported a mean age of 58 ± 11.4 years among Ghanaian stroke survivors [23]. These ages agree with the global trend of stroke occurring more in aged populations [24]. However, the global age incidence of stroke is declining [24,25], especially in LMIC [26], similar to observations from this current study. An appreciable 10.5% of participants were aged between 30-39 years, Table 1. The rising prevalence of hypertension among Ghanaian adults in rural and urban Ghana could partly explain these trends [27]. In this current study, 86.0% of participants had hypertension, documented as a major risk factor for stroke, especially among Ghanaians and Nigerians [4]. Stroke diagnosis in this current study was made on clinical grounds with or without CT imaging. The majority of participants (63.2%) could not afford the computed tomography (CT) imaging test. Ischaemic stroke could thus not be differentiated from intracerebral haemorrhage among this group. The comparative effect of haemorrhagic and ischaemic strokes on swallowing difficulty could thus not be determined and presents a limitation to this study. Among the 36.8% who afforded

Table 3: Nutritional status, nutritional risk and nutrient intake of participants with and without swallowing difficulty

Variable	Swallowing difficulty present	Swallowing difficulty absent	Total	p-value
Waist circumference (WC)(%)				
Normal WC	12 (38.7)	8 (36.4)	20 (37.7)	0.547a
Abdominal obesity	19 (61.3)	14 (63.6)	33 (62.3)	
Nutritional risk Score (%)				
Low risk (NRS < 3)	10 (30.3)	22 (91.7)	32 (56.1)	p < 0.001[a]*
High risk (NRS ≥ 3)	23 (69.7)	2 (8.3)	25 (43.9)	
Energy (kcal)	628	1017	688	0.025[b]*
(25^{th} -75^{th} Percentile)	(483 - 1003)	(600 -1586)	(512 – 1161)	
Carbohydrate (g)	69.0	155.7	89.9	0.001[b]*
(25^{th} -75^{th} Percentile)	(57.8 – 96.3)	(90.6 - 210.9)	(62.2 - 178.7)	
Total fat (g)	69.0	155.7	89.9	0.001[b]*
(25^{th} -75^{th} Percentile)	(57.8 – 96.3)	(90.6 - 210.9)	(62.2 - 178.7)	
Protein (g)	22.2	29.9	23.6	0.172[b]
(25^{th} -75^{th} Percentile)	(14.6- 30.0)	(17.3 – 44.3)	(14.6 – 40.7)	
Fibre (g)	3.5	7.7	5.4	0.009[b]*
(25^{th} -75^{th} Percentile)	(3.0-6.9)	(5.4 – 16.6)	(3.1 – 9.7)	

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Table 4: Relationship Between Nutritional Risk and Swallowing Difficulty

Unadjusted				
Variable	Nagel Kerke R^2	Odds ratio	P-Value	Confidence interval
Swallowing difficulty	0.459	25.30	P < 0.001*	4.97 - 128.72
Adjusted				
Variable	Nagel Kerke R^2	Odds ratio	P-Value	Confidence interval
Swallowing difficulty	0.754	8.40	0.010*	2.177 - 32.128
Age		9.86	0.058	0.921-105.522
Gender		0.02	0.040*	0.001 – 0.278
Occupation		1.04	0.926	0.458 – 2.360
Education		1.96	0.133	0.813 – 4.798
Multiple logistic regression analysis; *Significant at p < 0.05				

the test, 29.8% were ischaemic, and 7% were haemorrhagic stroke, Table 2. Ischaemic stroke was thus more prevalent than haemorrhagic stroke among those differentiated. Globally, the prevalence of ischaemic stroke is higher than haemorrhagic stroke (80%-90% vs 10%- 20%) [28]. Haemorrhagic stroke is more disabling than ischaemic stroke, causing severe morbidity and high mortality, with only 10% to 20% recovering functional independence [29]. In contrast, patients with ischaemic stroke show better prognoses with appropriate rehabilitation interventions and are more likely to regain functional independence. This suggests that a higher proportion of patients in this current study may regain functional independence with timely, appropriate interventions.

The majority (57.9%) of participants in this study had dysphagia. Dysphagia can lead to a 12-fold increase in developing aspiration pneumonia and subsequent malnutrition [10,30]. Nutritional intervention has been identified to improve neurologic and cognitive function in stroke patients. [13,31] The common symptoms of stroke increase the risk of malnutrition. Cognitive impairments and visual, language, and speech deficits can hinder effective communication about food preference and satiety, leading to malnutrition [13]. Poor oral hygiene related to poor oral care may predispose to aspiration pneumonia with subsequent malnutrition. Low-income families or lack of nursing care, pre-existing malnutrition and experiencing fatigue while eating leading to premature suspension of feeding all increase the risk of malnutrition in stroke patients [13]. Zhang et al. [32] reported a reduction in the risk of all-cause mortality for stroke patients who were screened for swallowing difficulty. In their study, stroke patients diagnosed with swallowing difficulty received rehabilitation to improve their swallowing and subsequently improve their dietary intake. In this current study, a significant majority of patients with swallowing difficulty had a high risk of malnutrition compared to those without swallowing difficulty (69.7% vs 8.3; $p < 0.001$), and an 8-fold risk of developing malnutrition, after adjusting for age, gender, education and occupation in a multiple logistic regression analysis. This was evident in their significantly lower energy, fat, carbohydrate and dietary fibre intake compared to those without dysphagia. Nutritional status was determined using waist circumference measurements, which, however, showed no record of underweight. All patients had either normal waist circumference or central obesity. The early timing of measurements (the first three days on admission) in this current study may have underestimated the risk of malnutrition. It is documented that the risk of malnutrition in stroke patients increases over long periods of admission, which is attributable to symptoms such as dysphagia and the hypercatabolic state in the body due to the type and severity of stroke [14]. Low prevalence is often reported during the early assessment at admission [13,14]. Nutritional risk assessment among stroke patients is not routinely done in primary care facilities. The authors strongly advocate a reversal from this trend toward routine assessment of nutritional risk, especially among patients diagnosed with swallowing difficulty. Its management should be based on the patient's risk and with dietitians' and caregivers' involvement [33]. Nutrition support, such as enteral feeding, can be useful for patients with swallowing difficulty if the nutritional risk is detected early. Early initiation of enteral feeding (within 24 to 48 hours of intensive care admission) is shown to reduce hospital stay and infective complications.[34]

Conclusion

Swallowing difficulty was found in over half of the study participants and was associated with an 8-fold higher nutritional risk after adjusting for age, gender, education and occupation. Early routine assessment of nutritional risk in stroke patients, followed with timely appropriate interventions, is strongly advocated as part of standard operating procedures for stroke management in primary care. This will ensure a reduction of stroke complications and mortality rates.

DECLARATIONS

Ethical considerations

The study protocol was reviewed and approved by the Ethics and Protocol Review Committee of the School of Biomedical and Allied Health Sciences, College of

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Health Sciences, University of Ghana, with reference number (SBAHS-PH/10515456/SA/2017-201N). Approval was also sought from the Medical Directorate of the Korle-Bu Teaching Hospital. Consent was obtained from all participants or their carers before they were recruited into the study.

Consent to publish
All authors agreed to the content of the final paper.

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Competing Interest
The authors declare that there is no conflict of interest regarding the publication of this article.

Author contributions
RKSD contributed to the conceptualisation and design of the study, data collection, data analysis and writing of the manuscript for publication. ASDA was responsible for the collection of data, dietary intake analysis and drafting of the manuscript. ASD participated in the conceptualisation and design of the study, data collection and critical review of the manuscript. MA helped with the writing and with the critical review of the manuscript.

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Availability of data
Data is available upon request to the corresponding author.

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