NUTRITIONAL STATUS OF CHILDREN WITH CEREBRAL PALSY ATTENDING KENYATTA NATIONAL HOSPITAL

A research dissertation for the partial fulfillment of a Masters of Medicine in Paediatrics and Child Health, University of Nairobi.

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DECLARATION

This dissertation is my original work and has not been presented for the award of a degree in any other university

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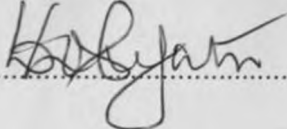
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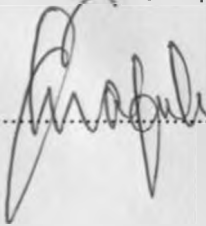This dissertation has been presented with our full approval as supervisors

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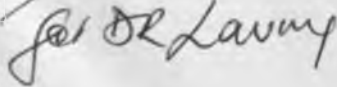
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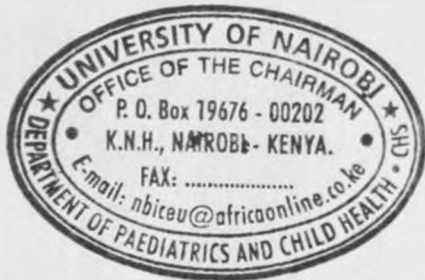
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LIST OF ABBREVIATIONS

KNH...........Kenyatta National Hospital

CP.............Cerebral palsy

WHO..........World Health Organization

W/H............Weight for Height

W/A............Weight for Age

H/A.............Height for Age

GMFCS........Gross Motor Function Classification System for Cerebral Palsy

TL...............Tibial length

GERD..........Gastro esophageal reflux disease

SES..............Social economic status

DEFINITION OF TERMS.

Oromotor dysfunction: is an inability to control the muscles of the mouth, including the tongue, lips and those involved in swallowing these leads to poor suck effort, choking, drooling of saliva.

Regurgitation: It is involuntary return of food from the stomach to the mouth.

Vomiting: it is to eject part or all of the contents of the stomach through the mouth.

Nutritional counseling: This is an ongoing process in which a health professional, usually a dietitian, works with an individual to assess his or her usual dietary intake and identify areas where change is needed.

Balanced diet; is a composition of different foods which includes adequate amounts of all the necessary nutrients (carbohydrates, fats, proteins, vitamins, and minerals) required for healthy growth and activity.

Hypotonia: decreased muscle tone

Hypertonia: increase in muscle tone

Caretaker: guardian or parent

Anthropometry: is the measure of human body to assist in understanding the variations and aid in different classifications.

Oedema: Swelling of the body due to abnormal infiltration of tissue with fluids

Dental carries: is a disease where bacterial processes damage tooth structure. These tissues progressively break down, producing dental cavities.

Physiotherapy: The treatment of disease, body defects, or body weaknesses by physical remedies, e.g. massage, special exercises

Occupational therapy: is a health care profession that aims to promote health by enabling individuals to perform meaningful and purposeful activities across the lifespan.

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ABSTRACT

Background: Cerebral palsy is the most common cause of physical disability in childhood, occurring in 3.6 per 1,000 children. It is caused by a static brain lesion in the neonatal period leading to a range of activity limitations. Although the primary impairment in CP is in motor function, poor growth and nutritional status is common in young children with cerebral palsy and impact detrimentally on physical and cognitive development as well as on health care utilization and quality of life in later childhood. Approximately one-third of children with CP are undernourished and many exhibit the consequences of malnutrition. The aim of this study was to assess the nutritional status and determine factors associated with poor nutrition in children with CP attending KNH outpatient clinics.

Objectives: The primary objective of this study was to determine the nutritional status of children with cerebral palsy and secondary objective was to find out the factors associated with poor nutritional status in these children.

Design: A hospital based cross-sectional study.

Setting: Pediatric Neurology Clinic, occupational and physiotherapy clinic of the Kenyatta national hospital.

Study Methodology: A cross-sectional study of 140 children was conducted at the KNH-neurology, physiotherapy and occupational therapy clinics over a period of three months. The study participants were children with cerebral palsy aged 6 to 139 months. Socio-demographic, nutritional data were obtained from the parents/guardians, and then physical examination and anthropometric measurements (weight and height) of the children was performed. The data was analyzed using SPSS version 17.3.

Results: During the 3 months study period, children with cerebral palsy in the age of 6 to 139 months with a median age of 17.0 months (11.25-30.75) participated in the study. Most of these Children were aged 6 to 23 months 92 (65.7 %) and out of the 140 children who participated in the study, 75 (53.6%) were male. About 86.4 % of these children were in GMFCS (gross motor functional classification system) level III and above. Overall, 70.3 % of children with cerebral palsy were malnourished, 35.0 % were severely wasted and 10.7% were severely stunted. The factors that were significantly associated with moderate to severe wasting were; age less than 2 years (p=0.0466), lack of regular source of income (p=0.04), higher GMFCS level (p= 0.035) and vomiting/regurgitation after feeding (p =0.031). Moderate

to severe stunting was significantly associated with age of more than 3 years (p=< 0.001), low level of care taker's education (p=0.026) and higher GMFCS (p=0.026).

Conclusion:

70.3 % of children with cerebral palsy were malnourished and Stunting was more prevalent in children with cerebral Palsy in the developed countries than in our study.

Factors that were significantly associated with moderate to severe wasting were; Age less than 2 years (p=0.0466), lack of regular source of income (p=0.04), higher GMFCS (p= 0.035) and vomiting or regurgitation after feeding (p =0.031).Moderate to severe stunting was significantly associated with; Age of more than 3 years (p=< 0.001), low level of caters education (p=0.026) and higher GMFCS (p=0.026).

It is contended that malnutrition is of high prevalence in children with cerebral palsy and therefore regular assessment and timely nutritional support may improve the situation.

1. INTRODUCTION

Cerebral palsy (CP) describes a group of disorders of the development of movement and posture causing activity limitation that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, behavior, and seizure disorder (1).

Cerebral palsy is the most common physical disability in children and affects 3.6/1,000 children (2). The overall prevalence has remained unchanged since the early part of the 20th century in most pediatric neurology clinics in developing countries with ranges between 10 and 40 percent in children under 16 years of age (3-5).

Although the primary impairment in CP is in motor function, poor growth and nutritional status are common (6, 7). Approximately one-third of children with CP are undernourished and many exhibit the consequences of malnutrition (8).Conversely, there is evidence to suggest that certain children with CP are at risk of obesity, particularly those with marked spasticity and who are relatively inactive (8,9).

Generally malnutrition is a common problem in most developing countries and it is a major contributor to child mortality and morbidity. Malnourished children are unable to fight disease and hence many are at risk of death. As a result this subject has been in the center of medical research at global level and even if results are often varied and unsatisfactory particularly in Sub-Saharan Africa, progress has been made due to improvement in health and other related services.

Malnutrition is commonly considered as an important risk factor that can produce a negative influence on the prognosis of patients with chronic neurological diseases (10). If severe malnutrition is left untreated it may lead to impairment of immune function (11), cognitive problems, and neuromuscular disabilities to mention just but a few (12). Therefore, identification of malnutrition and the risk factors associated with malnutrition is important for the early detection, treatment and for the prevention of late complications in the children's health.

There being no studies on nutritional status of children with cerebral palsy in our set up, the aim of this study was to evaluate the nutritional status and factors associated with malnutrition amongst CP children in KNH between the ages of 6 months to 12 years. It was hoped that the study will promote interest in the nutritional status of these unfortunate

children and discover the factors that are significantly associated with malnutrition and that can be corrected in a rehabilitation program.

1.1 LITERATURE REVIEW

Studies have been done on nutritional status of children with CP and in recent years, it has been shown that children with CP are at high risk of malnutrition (13, 14).

Stallings et al in 1997, studied 154 children between 2-17 years of age from Philadelphia and found that 30% were undernourished, 14% overweight and 23% stunted. Children in the youngest age-group were most at risk for poor nutritional status and delayed growth. Their findings suggested that children with diplegic or hemiplegic cerebral palsy are at risk for a variety of abnormalities of growth and nutritional status. They recommended that growth and nutritional assessment should be conducted periodically so that under- or over nutrition can be corrected when identified.

Tae Im et al in 2007, studied 70 children over the age of 25 months with CP from Korea and found that Low BMI percentile was in 23 children (32.9%) and 4.3 % were obese. They observed that Low BMI percentile tends to be frequently observed in groups III, IV, V of GMFCS.

Chowdhury et al in 2005 studied 177 children with CP from Bangladesh and found that 48.02% were under-nourished, 31.07% had marasmus and 0.56% had marasmic kwashiorkor. They recommended that a multidisciplinary approach in evaluating the feeding of these children is needed to provide comprehensive services.

Yilmaz S et al assessed feeding performance in patients with CP in 2004 and suggested that adequate nutrition is complicated by impaired self-feeding skills, oromotor dysfunction and the absence of demand for food.

Ifeyinwa and others in 2010 studied 98 children with cerebral palsy from Nigeria and found that 36% were malnourished, 2.04% overweight, 9.2% were stunted (67.7% of the stunted were infants), 16.3% were wasted and out of the malnourished children 49% were quadriplegic and the least affected (4.8%) were hemiplegic. Malnutrition was higher in the lower socio-economic class

1.2 HYPOTHESIS AND CONCEPTUAL FRAMEWORK

In this study it was hypothesized that most of the children with cerebral palsy attending KNH neurology, occupational and physiotherapy clinics were severely malnourished. The causes of malnutrition in children with cerebral palsy are multifactorial. A brief description of the mechanism involved which was evaluated in this study is hereby given.

1.2.1 Oromotor dysfunction.

This affects up to 90% of patients with CP (15) and is a major contributor to malnutrition in children with cerebral palsy (16, 17). Nutrient intake depends on getting adequate food, and having the ability to adequately chew and swallow of the food. These factors are associated with the functional status of a child with CP. Parents often report poor suck, breastfeeding difficulties, problems with the introduction of solid food and choking , even before the diagnosis of CP is made (15, 18).

1.2.2 Inadequate intake.

The caloric intake of children with CP is lower than that of age-matched controls (19). Some patients are able to feed themselves independently but lack hand-mouth coordination and may, therefore, spill an excessive amount of food. These children may also eat more slowly than other members of the household or require more time to eat than is allowed by the school schedule. As a result, regular family or school mealtime may be too short for them to ingest a sufficient amount of food.

Severely affected children are dependent on a caregiver at mealtime and are often unable to communicate hunger and satiety. The caregiver regulates their food intake. This may lead to underfeeding because it has been shown that the caregiver often overestimates the time spent feeding the child and also overestimates the child's caloric intake (19, 20).The caloric intake could be improved by adjusting food consistency, improving caloric content of the food. Studies have shown that increasing caloric intake with tube feedings improves nutritional status in cerebral palsy children (21).

Researchers have suggested that there is a relationship between the nutritional status and inadequate nutrient intake (22, 23). Nutritional rehabilitation has been associated with improved overall health, improved peripheral circulation, healing of decubitus ulcers, decreased spasticity, and decreased irritability in patients with cerebral palsy (24).

1.2.3 Increased losses

Gastro esophageal reflux affects a significant proportion of children with CP (25, 26). Frequent emesis and regurgitation may be a source of caloric loss. Reflux esophagitis may cause discomfort leading to food refusal and further decreasing food intake.

1.2.4 Altered metabolism

Children who are hypotonic and non ambulatory require few calories above the resting energy expenditure to thrive (27). However, children with increased muscle tone or with athetoid forms of CP may require an increased amount of Calories (28). Children with mild to moderate diplegic or hemiplegic CP who can ambulate often require more calories to perform daily activities than their normal counterparts (29).

Figure 1: Conceptual framework

Causes   **outcome**

Oromotor dysfunction
I.   Choking
II. Poor suck effort

Inadequate intake
I.   Amount of food spilled
II.   Time taken to feed
III. Frequency of meals in 24 hours

Altered metabolism
I.   functional status
II.   Type of cerebral palsy

Increase loss of food
I.   Vomiting or regurgitation

MALNUTRITION

Age, SES, lack of rehabilitation
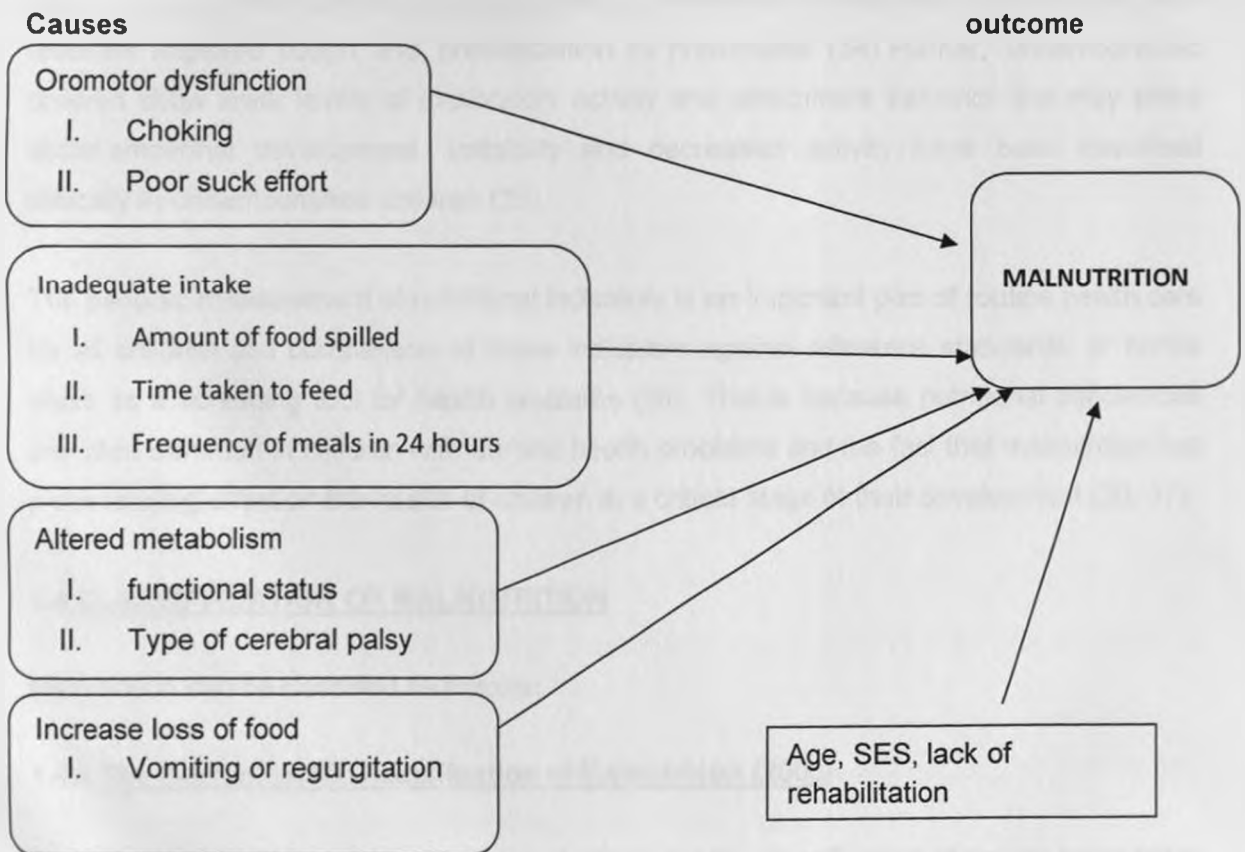
1.3 OVERVIEW OF MALNUTRITION IN CEREBRAL PALSY

1.3.1 Impact of malnutrition on health in children with cerebral palsy

The ill effects of malnutrition on physiology, motor function, neurological and psychological function are wide ranging and may be particularly devastating during early development.

In children with CP, malnutrition has been shown to increase the severity of gastro esophageal reflux, and nutritional rehabilitation has been shown to lessen the symptoms associated with gastro esophageal reflux (30). It impairs wound healing and immunity, which increases the risk of postoperative complications following surgery for fundoplication (31) and scoliosis repair (32). It also leads to diminished immune function (11), causing increased susceptibility to infection. Neurological consequences include diminished cerebral growth, delayed cognitive development, and abnormal behavior (12, 33).Diminished muscle strength leads to impairment in motor function as well as weakness of respiratory musculature, with resultant impaired cough and predisposition to pneumonia (34).Further, undernourished children show lower levels of exploratory activity and attachment behavior that may affect social-emotional development. Irritability and decreased activity have been described clinically in undernourished children (35).

The periodic measurement of nutritional indicators is an important part of routine health care for all children and comparison of these indicators against reference standards, or norms serve as a screening tool for health problems (36). This is because nutritional deficiencies are often common in children with chronic health problems and the fact that malnutrition has a devastating effect on the health of children at a critical stage of their development (20, 37).

1.4 CLASSIFFICATION OF MALNUTRITION

Malnutrition can be classified as follows:

1.4.1 The Current WHO Classification of Malnutrition (2006)

The World Health Organization developed criteria for the classification of severe malnutrition in children. These criteria are based upon the degree of wasting or stunting and the presence of edema. The child's weight for his or her height and the height for his or her age are expressed as Z-scores, calculated as the observed value minus the median value of the reference population divided by the standard deviation of the reference population.

In this classification the presence of edema implies severe malnutrition corresponding to Kwashiorkor or Marasmic Kwashiorkor in older classifications. However, to avoid confusion with the clinical syndrome of kwashiorkor, which includes other features, the term "edematous malnutrition" is preferred.

This classification was used to classify malnutrition.

Table 1: Current WHO Classification of Malnutrition (2006)

	Moderate malnutrition	Severe malnutrition (type)
Symmetrical edema	No	Yes (edematous malnutrition)
Weight-for-height	-3 to <-2 Z score	Z<-3
Height-for-age	-3 to <-2 Z score	Z<-3

1.5 ASSESSMENT OF NUTRITIONAL STATUS

Nutritional status is defined as the state of the body in relation to the consumption and utilization of nutrients. Poor nutritional status is the lack of sufficient nutrients to maintain healthy bodily functions.

Malnutrition is the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions (38).

The purpose of nutritional assessment is to identify children who will benefit from dietary counseling, those at risk of malnutrition as well as determine the severity and risk factors for malnutrition.

The following was used to determine the nutritional status of children with cerebral palsy in this study.

Anthropometry- this involves the measurement of the patient's weight, height, tibial length. These are simple, safe, quick, sensitive, inexpensive measurements that can be used in clinical practice to determine nutritional status. They were used to calculate the following indices: Weight for Height (marker for acute malnutrition) and Height for Age (marker for chronic malnutrition)

This study applied anthropometry as it is inexpensive, non-invasive, and relatively simple to conduct and offer a quick screening mode and malnutrition was classified using the current WHO classification.

1.5.1 Height measurement in children with cerebral palsy:

Measuring the actual height in patients with cerebral palsy has been shown to be difficult due to the presence of skeletal contractures, and inability of many of these patients to stand, hence segmental measurement are used to estimate stature in these children. The segmental measurements are Upper-arm length, tibial length, and knee height. These measurements are all reliable and valid proxies for stature in children with cerebral palsy up to 12 years of age (39).

Estimates of stature can then be calculated using published validated equations (39) and plotted on standard growth charts. For purposes of this study tibial length was used because it has the advantage of requiring only a standard flexible steel tape, which is readily available

Knee height:

This is the most reliable of the three measures, as reflected by the low technical error but it requires a caliper that most physicians would not have in their offices. measured with the knee and ankle each bent to a 90° angle using a Mediform sliding caliper (Medical Express, Beaverton,Ore), the distance between the heel to the anterior surface of the thigh over the femoral condyles.

Tibial length:

It is also reliable and has the advantage of requiring only a standard flexible steel tape, which is readily available. This is measured from the superomedial edge of the tibia to the inferior edge of the medial malleolus by means of a flexible steel tape.

Upper-arm length

This is the most difficult of the three measures to obtain and is the least reliable, measured as the distance from the acromion to the head of the radius when the child is upright (sitting or standing) and the arm relaxed and vertical with the elbow flexed to 90 by means of a digital anthropometer (Harpenden).

Table 2: Equation for estimating stature in CP: (39)

Segmental measure	Estimate of stature in cm
Upper arm length(UAL)	S=(4.35xUAL) + 21.8
Tibial length(TL)	S=(3.26x TL) +30.8(+/- 1.4)
Knee height (KH)	S=(2.69 x KH) +24.2

(S indicates estimated stature in centimeters)

1.6 GROSS MOTOR FUNCTIONAL CLASSIFICATION SYSTEMS FOR CP

Gross Motor function was classified according to Gross Motor Function Measure (GMFCS) (40).The GMFCS has been shown to be valid and reliable and has been Research analyzed to enable improved scaling (41). Children were then classified as being in one of five functional categories for the age bands under two years, two to four years, four to six years and six to twelve years. The classification was in ascending levels from I to V, where level V represents lack of independence even in basic antigravity postural control. The assessment questions are in the questionnaire

Table 3: Gross motor functional classification systems for cp

GMFCS	Motor function
Level I	Walks /sit without limitations
Level II	Walks /sit with limitations
Level III	Walks using a hand-held mobility device (canes, crutches)
Level IV	Self-mobility with limitations when using the hand held mobility device
Level V	Self mobility is totally impaired and has to be transported

1.7 CLASSIFICATION OF CEREBRAL PALSY

Type of CP was determined at each assessment according to Sanger et al (42) which he categorizes it as shown on the table below.

Table 4: Classification of cerebral palsy

class	subtype
Spastic—hypertonic	Hemiplegia, monoplegia, diplegia,,quatriplegia
mixed	Hypotonia +hypertonia
Nonspastic/hypotonic	Hyponotia.

2. STUDY JUSTIFICATION AND UTILITY

Cerebral palsy is the commonest physical disability in children and this special group of children is at increase risk of malnutrition. If malnutrition is left untreated, severe nutritional problems may be exacerbated, which may even cause impairment of the immune system, cognitive problems, and neuromuscular disabilities while when the nutritional condition is improved, researchers have shown several improvements in general health conditions of the children, such as decreases in irritability and spasticity, healing of pressure sores, and improvement in peripheral circulation. Therefore, identification of malnourished children and the risk factors associated with malnutrition is important for the early detection, treatment and for the prevention of late complications.

This study hoped to form a basis for the establishment of nutritional surveillance with the hope to discover the factors that are significantly associated with malnutrition and that can be corrected in a rehabilitation program.

3. RESEARCH QUESTION

What is the nutritional status of children with cerebral palsy attending KNH neurology, occupation and physiotherapy clinics?

4. STUDY OBJECTIVES

4.1 Primary objective:

To determine the nutritional status of children with cerebral palsy attending KNH outpatient clinics.

4.2 Secondary:

To determine the factors associated with malnutrition in children with cerebral palsy.

5. METHODOLOGY

5.1 Study design: This study was a hospital based cross-sectional study.

5.2 Study area

The study took place at the Kenyatta National Hospital's Paediatric neurology clinic, occupational therapy and physiotherapy centre.

5.3 Study Population: Children between six months and 12 years diagnosed to have cerebral palsy by a medical doctor. Patient's medical records was used to verify this diagnosis

5.4 Study period: Data was collected between the month of July and September 2011.

5.5 Inclusion criteria

Children between 6 months and 12 yrs of age diagnosed to have cerebral palsy by a medical doctor and whose parent/guardian gave consent

5.6 Exclusion criteria:

Children with:

- Known chronic illness affecting nutrition other than CP e.g. cardiac, renal disease, chromosomal abnormalities, HIV.
- Congenital malformation that would independently affect food intake e.g. cleft lip and / or palate.

5.7 Sample size

The minimum sample size was calculated using the Fishers' formula

$$n = \frac{Nz^2 p\,(1-p)}{d^2\,(N-1) + z^2 p(1-p)}$$

n = 138   n = Minimum sample size

N=is the population size

P=Estimated prevalence of malnutrition in children with CP

z is confidence level 95%, in this case set to 1.96

d refers to the margin of error in this case 0.08

According to Ifeyinwa B et al 2010 in Nigeria the prevalence of malnutrition was 36%.

If P= 36% then n for this study was 138.

5.7 Sampling Method

The consecutive sampling method was utilized. All children with cerebral palsy who met the inclusion criteria and whose parents/guardians gave consent during the study period were recruited.

5.8 Study procedure

This was a cross-sectional study carried out from July 2011 to September 2011 in the Paediatric Neurology, occupational and physiotherapy Clinic of the Kenyatta national hospital. Clearance was obtained from the Hospital Ethical Committee and informed written consent was obtained from each parent or guardian at the time of interview.

Children with a diagnosis of cerebral palsy made by medical doctor confirmed by patient records attending these clinics, aged between 6 months and 12 years, were consecutively recruited for the study. Patients with any other known chronic ailments that would independently affect nutritional status were excluded from the study.

A structured, pretested questionnaire was administered to the accompanying parent or caregiver to collect the bio demographic data of patients, presence of feeding problems such as poor sucking, choking while feeding, vomiting or regurgitation after feeding, dependence on care taker to feed and need for special feeding aid such as tubes. The consistency

(whether solid, semisolid or liquid) of food that the child ate with the least difficulty and how often the child ate in a day was also noted.

Each child's weight was measured to the nearest 0.1kg using a bath room scale that was calibrated every morning using a known weight. Children who could not stand were weighed in the arms of the mother. The difference between the combined weight of mother and child and that of mother alone was recorded as the child's weight. Height was measured using a secca- 26 stadiometer for patients aged more than 2 years who were able to stand flat-footed and straight. The recumbent length of participants less than 2 years of age and those who though 2 years or more were unable to stand erect was measured using a stadiometer with a fixed head rest and a movable foot board. Stature for all was estimated using tibial length. All measurements were recorded to the nearest 0.5cm.

All measurements were performed by the first author using the same instrument throughout the study. The anthropometric data were analyzed using the current WHO Growth chart (2006). Height and weight were used to classify the children into different types of malnutrition. Height for age and weight for height was used for stunting and wasting respectively. The children were also examined for clinical signs of malnutrition. Malnutrition was categorized using the WHO classification (2006).

Severity of motor impairment in the children with cerebral palsy was graded using the new classification system for severity of cerebral palsy (40).

6. ETHICAL CONSIDERATION.

The study was conducted after getting approval from the ethical committee of the Kenyatta National Hospital. All children were recruited to the study only after explaining to the parents/guardians about the study and after the parents/guardians signed the consent form. All information obtained from the study was kept confidential.

7. DATA ANALYSIS AND MANAGEMENT.

The data was subjected to statistical analysis using the SPSS 17.3 software package. Chi square test was used to determine associations and $P < 0.05$ was taken as significant.

8. RESULTS

8.1 Socio-demographic characteristics

This study was carried out within a period of three calendar months, running between the Months of July 2011 to September 2011.

In total, 140 children with cerebral palsy were recruited into the study. The age of the participants ranged from 6 to 139 months with a median age of 17.0 months (11.25-30.75). The majority of these children were aged 6--23 months 92 (65.7 %) and of the 140 children who participated in the study, 75 (53.6 %) were male.

A large majority of the patients (86.4 %) had the severe form of the disease, falling within level III and V of GMFCS. Level V, the severe form, accounted for about a third (22.9 %).

The most prevalent type of cerebral palsy was spastic which accounted for 61 (43.6 %) and the least common was mixed type 33 (23 %). Of the spastic (61), quadriplegic were 40/61 = 65.6%, contributing 28.6% of the total population. (Table 5)

Table 5: Socio-demographic characteristics of the study participants (n=140)

Characteristic	Frequency	Percentage (%)
Age (Months)		
6-23	92	65.7
24-35	18	12.9
36-60	17	12.1
>60	13	9.3
Male	75	53.6
GMFCS		
1	6	4.3
II	13	9.3
III	43	30.7
IV	46	32.9
V	32	22.9
Type of cerebral palsy		
Spastic	61	43.5
• Monoplegic	2	3.3
• diplegic	8	13.1
• hemiplegic	11	18.0
• quadriplegic	40	65.5
Hypotonic	44	31.4
mixed	35	25.0

8.2. Characteristic of the parents/ care-taker

The parents of only 1 (1 %) of the children had no formal education while the rest had attained either tertiary 56 (40%) or secondary 52 (37 %) education. About 66 (47.1 %) of the families had a regular source of income while the rest of the families 74 (52.9 %) had no regular income. (Table 6)

Table 6: Characteristic of the parents (N=140)

Characteristic	Frequency	Percentage (%)
Level of education of the caretaker Non formal	1	0.7
Primary	31	22.1
Secondary	52	37.1
Tertiary	56	40
Regular source of Income Yes	66	47.1

8.3 Feeding difficulties

Overall, 96 (68.6 %) out of the 140 participants had an oromotor dysfunction with commonest dysfunction being chocking 67 (47.9 %). Among the 113 patients who were breast feeding 29 were reported to be sucking poorly. A total of 60 (42.8 %) children either regurgitated or vomited after feeding. (Table 7)

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Table 7: Feeding difficulties

Feeding difficulties	frequency	percentage
Oromotor dysfunction		
poor suck effort	29 (n=113)	25.6
Child chokes while feeding	67(n=140)	47.9
Food spillage during feeding	(n=140)	
None	82	58.6
Less than half	42	30.0
Half or more	16	11.4
Regurgitate/vomit	60 (n=140)	42.8
Inadequate food intake due to:		
Dental caries	20 (n=140)	14.3
Oral sore	9 (n=140)	6.4

8.4 Number of meals per day.

All the patients were reported to receive three meals per day, with 90.7 % (127) receiving two snacks in between. Thirty-three (23.6 %) children had taken at least one balanced diet in the previous 24 hours and 6 (4.3 %) had had two balanced meals. (Table 8)

Table 8: Number of meals per day

Food intake in past 24 hours	Frequency n=140	Percent
Number of meals (including snacks)		
Three	13	9.3
Three meals and two snacks	127	90.7
Number of meals constituting balanced diet		
None	101	72.1
One	33	23.6
Two	6	4.3

8.5 Nutritional status of the study population

Overall 70.3 % of the children were malnourished. Using the weight for height classification, 49 (35.0%) had acute severe wasting (WHZ < -3). About 37 (26.4 %) were moderately wasted and none of the children had edema. A total of 22 (15.8 %) children were stunted with HAZ < -2SD; among them 15 (10.7 %) had severe stunting. (Table 9)

Table 9: Nutritional status of the study population (N=140)

	Nutritional indices reported as Z scores	
	Weight for height Z score WHZ N=140	Height for age Z score HAZ
Z score	No (%)	No (%)
≤ -3	49(35.0)	15(10.7)
-2.99 to -2	37(26.4)	7(5.1)
> -2	54(38.6)	118(84.2)

8.6 Association between socio-demographic factors and moderate to severe wasting

Wasting was significantly associated with children's age (p = 0.046) and lack of regular family income (p = 0.041). Wasting was more common among children in households with no regular income 51 (59.3 %) compared to those in households reporting regular source of income 35 (40.7 %). Wasting was most common among children less than 2 years of age 61 (70.9 %) and least common among children aged more than 3 years 11 (12.8 %).The gender of patients did not show a statistically significant association with either wasting (p = 0.4) nor stunting (p = 0.11). Moderate to severe wasting was significantly higher among patients with high GMFCS levels (p = 0.035).About 27.9 percent of patients with Level V compared to 9.3 % of the participants in level II and below had moderate to severe wasting. (Table 10)

Table 10: Association between socio-demographic factors and wasting

Variable	Wasting		OR (95% CI)	P value
	Wasted (WHZ<-2)	Normal (WHZ≥-2)		
Age group				
<2 years	61 (70.9%)	31 (58.5)	2.5 (1.0-6.2)	0.046
2-3 years	14 (16.3%)	8 (15.1)	2.2 (0.7-7.2)	0.181
>3 years	11 (12.8%)	14 (26.4)	1.0	
Sex				
Male	44 (51.2)	32 (59.3)	0.8 (0.4-1.5)	0.400
Female	42 (48.8)	22 (40.7)	1.0	
Presence of regular income				
Yes	35 (40.7)	32 (59.3)	0.5 (0.2-1.0)	0.041
No	51 (59.3)	22 (40.7)	1.0	
GMFCS				
≤II	8 (9.3)	11 (20.4)	1.0	
III	25 (29.1)	18 (33.3)	1.7 (0.6-5.3)	0.330
IV	29 (33.7)	17 (31.5)	2.1 (0.7-6.4)	0.180
V	24 (27.9)	8 (14.8)	3.8 (1.1-12.8)	0.035

8.7 Association between socio-demographic factors and stunting and (n=140)

Moderate to Severe stunting showed statistically significant associations with both the age of children (p < 0.001) and the caretakers level of education (p = 0.026). Stunting increased with increase in the age of the participants; it was as low as 7 (30.4 %) for less than 2 year of age to as high as 13 (56.5 %) in children more than 3 years of age. On the other hand, stunting decreased with increasing level of caretaker education from 4 (17.4 %) among children of mothers with tertiary level of education to 8 (34.8 %) for children of mothers with primary education. Children with higher GMFCS levels were more likely to have stunting compared to those with lower levels (p = 0.026). (Table 11)

Table 11: Association between socio-demographic factors and stunting (n=140)

Variable	Stunting		OR (95% CI)	P value
	Stunted (HAZ<-2)	Normal (HAZ≥-2)		
Age group				
<2 years	7 (30.4%)	85 (72.6%)	0.1 (0.0-0.2)	<0.001
2-3 years	3 (13.0%)	19 (16.2%)	0.2 (0.0-0.7)	0.012
>3 years	13 (56.5%)	13 (11.1%)	1.0	
Sex				
Male	16 (69.6)	60 (51.3)	2.2 (0.8-5.7)	0.11
Female	7 (30.4)	57 (48.7)	1.0	
Level of caretaker Education				
Primary or none	8 (34.8)	24 (20.5)	4.3 (1.2-15.8)	0.026
Secondary	11 (47.8)	42 (35.9)	3.5 (1.0-11.8)	0.044
Tertiary	4 (17.4)	51 (43.6)	1.0	
Presence of regular income				
Yes	12 (52.2)	54 (46.2)	1.3 (0.5-3.1)	0.597
No	11 (47.8)	63 (53.8)	1.0	
GMFCS				
≤II	-	9 (7.9)		0.026
III	2(8.0)	29(25.4)		
IV	7(28.0)	39(34.2)		
V	16(64.0)	37(32.5)		

8.8 Association between feeding difficulties and wasting

Regurgitation or vomiting after feeds was significantly associated with wasting (p = 0.031). None of any of the other feeding difficulty was significantly associated with wasting. (Table 12)

Table 12: Association between feeding difficulties and wasting

Variable	Wasting		OR (95% CI)	P value
	Wasted (WHZ<-2)	Normal (WHZ≥-2)		
Poor suck effort(n=113) Yes No	19 (26.0) 54 (74.0)	10 (25.0) 30 (75.0)	1.2 (0.5-2.9)	0.731
Choking Yes No	44 (51.2) 42 (48.8)	23 (42.6) 31 (57.4)	1.5 (0.7-2.9) 1.0	0.268
Regurgitates/vomits after feeding Yes No	43(50.0) 43(50.0)	17(31.5) 37(68.5)	2.14(1.92-5) 1.0	0.031
Duration taken while feeding Less than 20 minutes More than 20 minutes	20 (23.3) 66 (76.7)	19 (35.2) 35 (64.8)	0.6 (0.3-1.2) 1.0	0.148

8.9 Association between feeding difficulties and stunting

None of the feeding difficulties was significantly association with stunting. (Table 13)

Table 13: Association between feeding difficulties and stunting

Variable	Stunting		OR (95% CI)	P value
	Stunted (HAZ<-2)	Normal (HAZ≥-2)		
Poor suck effort	(n=113)			
Yes	4 (30.8)	25 (25.0)	1.3 (0.4-4.7)	0.737
No	9 (69.2)	75 (75.0)		
Choking				
Yes	10 (43.5)	57 (48.7)	0.8 (0.3-2.0)	0.646
No	13 (46.5)	60 (51.3)	1.0	
Regurgitates/vomits after feeds				
Yes	9 (39.1)	51 (43.6)	0.8 (0.3-2.1)	0.693
No	14 (60.9)	66 (56.4)	1.0	
Duration taken while feeding				0.460
Less than 20 minutes	5 (21.7)	35 (29.9)	0.7 (0.2-2.0)	
More than 20 minutes	18 (78.3)	82 (70.1)	1.0	
Frequency of feeding in 24hrs				
4 times	17 (77.3)	74 (62.7)	1.0	0.919
3- <4 times	3 (13.6)	31 (26.3)	1.1 (0.2-5.6)	0.191
2-3 times	2 (9.1)	8 (10.1)	0.4 (0.1-1.5)	1.000
Once	0 (0.0)	1 (0.8)	-	

8.10 Association between rehabilitation and malnutrition

This study showed that Children whose parents received nutritional counseling were less likely to be wasted 39 (45.3 %) compared to 47 (54.7 %) who were wasted but did not receive nutritional counseling. It is to be noted however, that the duration of physiotherapy or occupational therapy was not significantly associated with wasting. (Table 14)

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Table14: Association between rehabilitation and moderate to severe wasting

Variable	Wasting		OR (95% CI)	P value
	Wasted (WHZ<-2)	Normal (WHZ≥-2)		
nutritional counseling				
Yes	39 (45.3)	18 (33.3)	1.8 (0.9-3.6)	
No	47 (54.7)	36 (66.7)	1.0	0.121
Physiotherapy/occupational therapy duration				
Less than 3months	32 (37.6)	17 (30.9)	1.5 (0.7-3.4)	0.305
3-6months	20 (23.5)	12 (21.8)	1.4 (0.6-3.4)	0.486
More than 6months	33 (38.8)	26 (47.3)	1.0	

8.11 Association between rehabilitation and moderate to severe stunting

Most parents who had stunted Children that participated in this study 12 (52.2%) received nutritional counseling compared to 11(47.1 %) whose parents did not receive counseling. This could be a reflection that healthcare workers were sending parents with stunted children for nutritional counseling; however this was not significantly associated with malnutrition. (Table 15)

Table 15: Association between rehabilitation and moderate to severe stunting

Variable	stunted		OR (95% CI)	P value
	Stunted (HAZ<-2)	Normal (HAZ≥-2)		
Nutritional counseling				
Yes	12 (52.2)	44 (37.6)	1.8 (0.7-4.5)	0.192
No	11 (47.8)	73 (62.4)	1.0	
Physiotherapy/occupational therapy duration				
Less than 3months	9 (39.1)	40 (34.2)	0.9 (0.3-2.4)	0.837
3-6months	2 (8.7)	30 (25.6)	0.3 (0.1-1.3)	0.102
More than 6months	12 (52.2)	47 (40.2)	1.0	

9. DISCUSSION

Malnutrition is commonly considered as an important risk factor that can produce a negative influence on the prognosis of patients with chronic neurological diseases (10). If severe malnutrition is left untreated it may lead to impairment of immune function (11) and neuromuscular disabilities to mention just but a few (12). Identification of malnutrition and the risk factors associated with malnutrition are therefore important for the early detection, treatment and for the prevention of late complications in the children's health.

This study sought to assess the nutritional status and factors associated with malnutrition among children with cerebral palsy who were attended to at Kenyatta national hospital outpatient clinics using anthropometrics measurements.

Majority of the participants in the study ranged between 6 to 23 months 92 (65.7 %) and this was similar to other studies such as that by Tiem em et al where 30% of the study population was aged less than 3 years and Ifenwe whose study population were infants between the age of 6 months to twelve months. Studies have shown that the poor response of the motor impairment to treatment had been advanced as a reason why most parents default from clinics leaving mainly the newly diagnosed cases that are usually the very young children (4). The ratio of males to females who participated in the study was 1.2:1, respectively. Most of other studies have shown that male sex may be a risk factor for cerebral palsy (43) and most of the parents did not have a regular source of income 74 (52.9 %).

The overall prevalence of malnutrition in this study was 70.3 % and although this was lower than what was found by Del A et al in Peru where malnutrition was at 81.1%, it was higher than the figures found in Asia. Singh et al in India found malnutrition to be at 50.6 % while Chowdhury and others in 2005 in Bangladesh found malnutrition to be at 48.02%.
Moderate to severe wasting in the study population was 61.4 % while stunting was noticed in 15.8 % of the participants. Wasting was higher than the figures reported in other studies like the Taiwan study by Jen-wen et al where wasting in CP children was at 41.2 % and Ana L et al in Brazil found wasting to be 38.6%.

Stunting in our study population was lower compared to studies in the west. Stalling et al in 1997 in Philadelphia found stunting to be 23 % in children with cerebral palsy whereas Jen-wen et al in Taiwan found stunting to be at 36 %. In the developed countries, children with cerebral palsy up to adolescent age are seen in the clinic. Our study included children up to

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the age of 12 years, but most of the participants were aged below 2 years. This might account for the higher rate of stunting in studies from the West and other developed countries because it is generally acknowledged that stunting is a measure of chronic malnutrition.

Our study found that among the factors associated with malnutrition, age was significantly associated with moderate to severe wasting as well as stunting (P= 0.046, P= p < 0.001 respectively). Wasting was most common among children less than 2 years of age 61 (66.3%) and least common among children aged more than 3 years 11 (12.8 %). The reason for the preponderance of wasting in this age group is not clear.

It was noticed that stunting increased with increase in the age of the participants and it was as low as 7 (30.4 %) in children less than 2 year old to as high as 13 (56.5%) in children more than 3 years of age. From other studies, stunting has been noted to worsen with advancing age (7) and this could be because stunting is a measure of chronic malnutrition.

The other factor that was significantly associated with both wasting and stunting was the severity of the motor disability. The nutritional status got poorer as severity of cerebral palsy increased. About 24 (27.9 %) of participants in Level V compared to 8 (9.3 %) of the participants in level II and below had moderate to severe wasting, a fact that was statistically significant (p=0.035). Similarly, children with higher GMFCS levels were more likely to have stunting compared to those with lower levels (p = 0.026). This significant association of severe motor impairment with poor nutritional status agreed with previous studies (7).

Wasting was more common among children in households with no regular income 51 (59.3%, p = 0.04) and this finding were in keeping with what Ifenwe found in 2010 in Nigeria, wherein it was found that the proportion of subjects who were malnourished were from families with low socioeconomic class. Ana Lucia et al in 2008 in Brazil also found malnutrition to be more frequent in children from lower socioeconomic status.

Moderate to severe stunting showed statistically significant associations with caretakers level of education (p = 0.026). Stunting decreased with increasing level of caretaker education from 1 7.4 % among children of mothers with tertiary level of education to 34.8 % for children of mothers with primary education. Our findings on level of mother's education and stunting are in keeping with many studies conducted in Africa.

Studies undertaken in Uganda by Jitta et al (44) and Vella et al (45) showed that there was significant association between malnutrition, specifically stunting, and the educational level of the mother. However a study conducted in Uganda by Owor et al (46) in 2009 showed otherwise; it was found that there was no correlation between the educational level of the care taker and severe malnutrition. These different results could be due to the fact that Owor et al focused only on severely malnourished children disregarding cases with mild or median malnutrition

Regurgitation or vomiting after feeds was significantly associated with wasting (p = 0.031). However, regurgitation or vomiting after feeds was not significantly associated with prevalence of stunting (p = 0.72). The loss of nutrients through vomiting or regurgitation could be very severe that the affected patient does not live long for this factor to cause stunting. It has been observed previously that gastroesophageal reflux affects a large portion of children with CP (25) and some of the consequences of gastroesophageal reflux include emesis resulting in increased nutrient losses. Although having a feeding problem was a risk factor for malnutrition, none of any of the other feeding problem was significantly associated with wasting or stunting.

The frequency of meals and time spent feeding the child did not show significant influence on the nutritional status. Previous studies have shown that prolonged mealtimes, sometimes 3 hours per day to 6 hours per day, may not even be sufficient to compensate for the child's feeding inefficiency resulting in inadequate caloric intake (47).

This study showed that Children whose parents received nutritional counseling were less likely to be wasted 39 (45.3 %) compared to 47 (54.7 %) who were wasted but did not receive nutritional counseling. It is to be noted however, that the duration of physiotherapy or occupational therapy was not significantly associated with wasting. Most parents who had stunted Children that participated in this study 12 (52.2%) received nutritional counseling compared to 11(47.1 %) whose parents did not receive counseling. This could be a reflection that healthcare workers were sending parents with stunted children for nutritional counseling however this was not significantly associated with malnutrition.

10. CONCLUSION:

- According to our study, 70.3 % of children with cerebral palsy were malnourished.

- Factors that were significantly associated with moderate to severe wasting were; Age less than 2 years (p=0.0466), lack of regular source of income (p=0.04), higher GMFCS level (p= 0.035) and vomiting/regurgitation after feeding (p =0.031).

- Moderate to severe stunting was significantly associated with; Age of more than 3 years (p=< 0.001), low level of caters education (p=0.026), higher GMFCS (p=0.026)

11. RECOMMENDATION:

Children with CP should be screened regularly for malnutrition. This should be more frequent in children with regurgitation or vomiting, severe motor disability and in children whose guardians have non-formal or primary level of education.

Health education to the guardian/parent taking care of these children is paramount because a mother's education can exert a positive influence on children's health and survival.

12. Study limitations:

The study was based on only children attending KNH outpatient clinic, therefore this was not a general representation of the CP population in Kenya. Future studies should be multicenter, covering greater number of children with cerebral palsy to evaluate the nutritional status of these children.

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13. APPENDIX

APPENDIX 1: <u>INFORMED CONSENT FORM</u>

Title: The Nutritional Status of children with cerebral palsy attending the Kenyatta National Hospital.

Investigator:

Dr. Nancy simat koriata

University of Nairobi- Department of Paediatrics and Child Health

Mobile:0721782894

Supervisors: Dr D. Oyatsi, Prof E. Wafula, Dr A. Laving

Investigators Note: The aim of this form is to give you some information about the study. The information will help you decide whether or not your child will be part of the study.

Introduction: CP is the commonest physical disability in children and is commonly associated with malnutrition which has a huge negative impact on health including: Psychological, physiological function, healthcare utilization, societal participation, motor function and survival.

Knowledge of prevalence, magnitude and contributing factors to this problem will be useful in defining appropriate interventions

Procedure: If you are willing for you and your child to be part of this study, I will ask you some questions about you and your child. Then I will conduct physical examination on your child and take his weight, height and Tibial length using the standard procedure.

Risks: some of the questions I will ask might be personal but you need not feel obliged to answer any question with which you are uncomfortable, and you and your child can still be part of the study. Your child might experience minor discomfort when taking the above measurements.

Benefits: During the child's physical examination, any new information found will be relayed to the doctor(s) taking care of the child so that your child gets the relevant treatment. Your child might not directly benefit from this study but your participation in this study will help other children in the future.

Confidentiality: if you consent to participate in this study, the information you give will be held in the strictest confidence. They will be only shared with the doctor managing your child for the benefit of the child in terms of treatment and care.

Reassurance: If you opt out of this study, management of your child will in no way be interfered with. If you decide to participate in this study, you may withdraw at any time without explanation or consequence.

Ethical consideration: I get an approval from the Ethical committee to go ahead with my study. In case you have ethical issues to inquire about you can contact the KNH/UON ethical committee through

Prof A N Guantai

Secretary, KNH/UON-ERC

Kenyatta National Hospital

Hospital Rd, along Ngong Rd.

P.O.Box 20723, Nairobi

Tel: 726300-9

Fax: 725272

To indicate that you understand the conditions of this study and that you consent to participate in it, please sign or put your thumbprint in the space provided below.

I _____ confirm that the study has been explained to me and I give consent to participate in it.

Signature/Thumb print _____

Investigators Signature _____

Date_____

<u>ASSESSMENT OF NUTRITIONAL STATUS OF CHILDREN WITH CEREBRAL PALSY ATTENDING KNH</u>

RESEARCHER: <u>DR NANCY SIMAT KORIATA (MMED. PEDIATRICS & CHILD HEALTH)</u>

QUESTIONAIRE SERIAL NO: [　　] Date when data was collected:

SECTION 1: SOCIAL- DEMOGRAPHIC DATA

1. Name [　　　　　　　]

2. Age: date of birth……..month……..year….

3. Sex   1 = M   2 = F

4. Parent/guardian mobile number_____

5. Educational level of the caretaker
   - a) Non-Formal   b) primary
   - c) Secondary   d) Tertiary

6. Does anyone in the household have a regular source of income?
   - 1) Yes   2) No

7. Does the child suffer from any other known chronic illness?

   1. Yes   2. No

   If yes which one? _____

SECTION 2: NUTRITIONAL HISTORY

Oromotor dysfunction

1. Does the child have poor suck effort?   1) Yes   2.No   3.not applicable

2. Does the child choke while feeding?   1) Yes   2) No

Increase loss of food

1. Does the child regurgitates food or vomits after feeding 1) Yes   2) No

2. Does the child spill food?

   1. Yes (a) less than half of the feeds b) half or more of the feeds

   2. No

Inadequate intake

1. What did the child eat yesterday?

Time	Food given	Ingredients

Effect of rehabilitation

1. Is the child on any feeding aid?   1) Yes   2) No

   If yes, specify_____

2. Have you received any nutritional counseling as part of your child's management?

   1). Yes   2).No

3. How long have you been on physiotherapy/occupational therapy?

   a) Less than or equals 3 months b) 3 to 6 months c) more than 6 months.

   d) None

SECTION 3: PHYSICAL EXAMINATION

a.	Oral sores	1) Yes	2) No
b.	Dental caries	1) Yes	2) No
c.	Visible severe wasting	1) yes	2)No
d.	Lower Limb pitting edema	1) Yes	2)No

e. Tone

    i. Spastic — a) Diplegic b) Monoplegic c)Hemiplegic d) quadriplegic

    ii. nonspastic

    iii. mixed

SECTION 4: ANTHROPOMETRIC MEASUREMENT:

a. Weight ___1^{st}) ____ 2nd)____average_____ Kg (To the nearest 0.1 kg)

b. Height/Length __1^{st}) ____ 2nd)___average __ Cm (To the nearest 0.1 cm)

c. Tibial length (TL) 1st) ____ 2nd)____average__ Cm (To the nearest 0.1 cm)

d. Estimated stature in cms =(3.26xTL)+30.8

e. W/H(Z score)

f. H/A (Z score)

SECTION 5: GROSS MOTOR FUNCTION CLASSIFICATION SYSTEM FOR CEREBRAL PALSY (GMFCS)

A. Level 1

B. Level II

C. Level III

D. Level IV

E. Level V

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SECTION 6: Gross Motor Function Classification System for Cerebral Palsy (GMFCS). (41)

Before 2nd Birthday

Level I -Infants:

Move in and out of sitting and floor sit with both hands free to manipulate objects.

Crawl on hands and knees, pull to stand and take steps holding on to furniture.

Walk between 18 months and 2 years of age without the need for any assistive mobility device.

Level II -Infants:

Maintain floor sitting but may need to use their hands for support to maintain balance.

Creep on their stomach or crawl on hands and knees.

May pull to stand and take steps holding on to furniture.

Level III -Infants:

Maintain floor sitting when the low back is supported.

Roll and creep forward on their stomachs.

Level IV -Infants:

Have head control but trunk support is required for floor sitting.

Can roll to supine and may roll to prone.

Level V –infants:

Physical impairments limit voluntary control of movement.

Are unable to maintain antigravity head and trunk postures in prone and sitting position.

Require adult assistance to roll.

Children Aged 2 to 4 Years

Child

I. **Can sit on own and moves by walking without a walking aid**
   and is able to balance in sitting when using both hands to play
   and can move in and out of sitting and standing positions without help from an adult
   and prefers to move by walking

II. **Can sit on their own and usually moves by walking with a walking aid**
   and may have difficulty with sitting balance when using both hands to play
   and can get in and out of sitting positions on own
   and can pull to stand and cruise holding onto furniture
   and can crawl, but prefers to move by walking

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III. **Can sit on own and walk short distances with a walking aid** (such as a walker, rollator, crutches, canes, etc.)

and may need help from an adult for steering and turning when walking with an aid

and usually sits on floor in a "W-sitting" position and may need help from an adult to get into sitting

and may pull to stand and cruise short distances

and prefers to move by creeping and crawling

IV. **Can sit on own when placed on the floor and can move within a room**

and uses hands for support to maintain sitting balance

and usually uses adaptive equipment for sitting and standing

and moves by rolling, creeping on stomach or crawling

V. **Has difficulty controlling head and trunk posture in most positions**

and uses specially adapted seating to sit comfortably

and has to be lifted by another person to move about

Children Aged 4 to 6 Years

I. **Can walk on their own without using a walking aid, including fairly long distances, outdoors and on uneven surfaces**

and can move from the floor or a chair to standing without using their hands for support

and can go up and down stairs without needing to hold the handrail

and is beginning to run and jump

II. **Can walk on their own without using a walking aid, but has difficulty walking long distances or on uneven surfaces**

and can sit in a normal adult chair and use both hands freely

and can move from the floor to standing without adult assistance

and needs to hold the handrail when going up or down stairs

and is not yet able to run and jump

III. **Can walk on their own using a walking aid** (such as a walker, rollator, crutches, canes, etc.)

and can usually get in and out of a chair without adult assistance

and may use a wheelchair when travelling long distances or outside

and finds it difficult to climb stairs or walk on an uneven surface without considerable help

IV. **Can sit on their own but does not stand or walk without significant support and adult supervision**

and may need extra body / trunk support to improve arm and hand function

and usually needs adult assistance to get in and out of a chair

and may achieve self-mobility using a powered wheelchair or is transported in the community

V. **Has difficulty sitting on their own and controlling their head and body posture in most positions**

and has difficulty achieving any voluntary control of movement

and needs a specially-adapted supportive chair to sit comfortably

and has to be lifted or hoisted by another person to move

Children Aged 6 to 12 Years

Child

I. **Can walk on their own without using walking aids, and can go up or down stairs without needing to hold the handrail**

and walks wherever they want to go (including uneven surfaces, slopes or in crowds)

and can run and jump although their speed, balance, and coordination may be slightly

II. **Can walk on their own without using walking aids, but needs to hold the handrail when going up or down stairs and** often finds it difficult to walk on uneven surfaces, slopes or in crowds

III. **Can stand on their own and only walks using a walking aid** (such as a walker, rollator, crutches, canes, etc.)

and finds it difficult to climb stairs, or walk on uneven surfaces

and may use a wheelchair when travelling for long distances or in crowds

IV. **Can sit on their own but does not stand or walk without significant support**

and therefore relies mostly on wheelchair at home, school and in the community

and often needs extra body / trunk support to improve arm and hand function

and may achieve self-mobility using a powered wheelchair

V. **Has difficulty sitting on their own and controlling their head and body posture in most positions**

and has difficulty achieving any voluntary control of movement

and needs a special supportive chair to sit comfortably

and has to be lifted or hoisted by another person to move

APPENDIX 3 <u>THE WHO MEASURING TECHNIQUES</u>

<u>THE WHO MEASURING TECHNIQUES</u>

<u>Weight measurement</u>

- A bathroom weighing scale was used.
- Every morning before the scale was used; it was checked against a known weight of 10 Kg.
- The clothes of the child were removed.
- The child stood on the scale and the measurement taken.
- The measurer reads the reading perpendicular to the pointer to the nearest 0.1 kg and announced loudly.
- The guardian was weighed holding the child that was unable to stand and his/her weight subtracted from the total weight to get the child's true weight.
- Two readings were made and average taken

<u>Height measurement:</u>
A measuring board was used for measuring height in children.

For children who are less than two years of age or those who are more than two years and cannot stand:

- The child was gently placed on the board with the soles of the feet flat against the fixed vertical part.

- The head was put near the moving part (cursor)

- The child was made to lie straight in the middle of the board, looking directly up.

- The assistant held the feet firmly against the feet board and places one hand and the knees of the child.

- The measurer gently held the child' head places the curser against the crown of the head and reads out the length to the nearest 0.1 cm.

- The assistant repeated the reading and records it in the recording form.

For children 2 years of age and above:

- The child was made to stand on a horizontal surface against a vertical measuring device.
- The assistant makes sure that the child stands straight with the heels, knees against the wall.
- The cursor was then lowered onto the child' crown of the head.
- The length was read to the nearest 0.1 cm.
- The measurer read out loud; the assistant repeated it and recorded it on the recording form.

In hemiplegic subjects or those with asymmetrical motor function, measurement was taken from the less affected side.

Tibial length:

Measuring the actual height in patients with cerebral palsy has been shown to be difficult due to the presence of skeletal contractures, and inability of many of those patients to stand. Thus, the height will be calculated from the tibial length using the following equation: estimated tibial height = (3.26xTibial Length) +30.8 in cms. (Table 1)

The tibial length was measured using a non stretchable stainless tape, as the distance between the superiomedial edge (medial condyle) of the tibia and the medial malleolus (44) as shown in figure 2.Tibial length was taken in all children recruited for this study.

Figure 2: measurement of tibial length
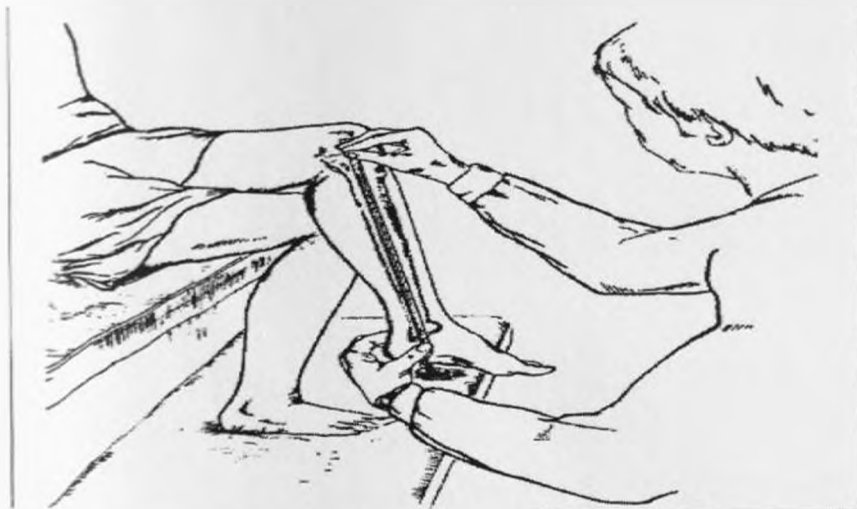
APPENDIX 4 GROSS MOTOR FUNCTIONAL CLASSIFICATION SYSTEMS FOR CP

Gross Motor function was classified according to Gross Motor Function Measure (GMFCS) (41).The GMFCS has been shown to be valid and reliable and has been Research analyzed to enable improved scaling (43). Children were then classified as being in one of five functional categories for the age bands under two years, two to four years, four to six years and six to twelve years. The classification was in ascending levels from I to V, where level V represents lack of independence even in basic antigravity postural control. The assessment questions are in the questionnaire

All the measurements were recorded on the questionnaire. The positive findings on examination and the nutritional status were communicated to the primary clinician managing the children.

APPENDIX 4 <u>BUDGET</u>

Personnel (2 assistants)	12,000
Measurement tools (W. scale, M. board, 2 tapes)	10,000
Stationary	2,000
Operating expenses (Data analysis)	10,000
Miscellaneous	3,000
Total	37,000

The budget was sponsored by the researcher.

Ref: KNH-ERC/ A/133

21st June 2011

Dr. Nancy Simat Koriata
Dept. of Paediatrics & Child Health
School of Medicine
University of Nairobi

Dear Dr. Koriata

RESEARCH PROPOSAL: "ASSESSMENT OF THE NUTRITIONAL STATUS OF CHILDREN WITH CEREBRAL PALSY ATTENDING K.N.H USING ANTHROPOMETRIC MEASUREMENTS" (P90/03/2011)

This is to inform you that the KNH/UON-Ethics & Research Committee has reviewed and **approved** your above revised research proposal . The approval periods are 21st June 2011 20th June 2012.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimens must also be obtained from KNH/UON-Ethics & Research Committee for each batch.

On behalf of the Committee, I wish you a fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of the data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A N GUANTAI
SECRETARY. KNH/UON-ERC
c.c.   The Deputy Director CS, KNH
        The Dean, School of Medicine, UON
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