ADDIS ABABA UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE

DEPARTMENT OF PEDIATRIC AND CHILD HEALTH

ASSESSMENT OF NUTRITIONAL STATUS AND ASSOCIATED FACTORS OF CHILDREN WITH CHRONIC KIDNEY DISEASE IN TIKUR ANBESSA SPECIALIZED HOSPITAL PEDIATRIC RENAL CLINIC 2024/25 ADDIS ABABA, ETHIOPIA

BY

ADINO MELKAMU

A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN A PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF SPECIALTY IN PEDIATRIC AND CHILD HEALTH

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Abstract

Back ground: Poor growth in children with CKD, which is a marker of disease severity, is associated with significant morbidity and mortality. We studied nutritional status and associated factors in our children with CKD. The study aims were to evaluate the nutritional status and associated factors among children with CKD at the Pediatric Renal Clinic at Tikur Anbessa Specialized Hospital 2024/25.

Methods: This study was conducted at Tikur Anbessa Specialized Hospital/TASH/. An institution based cross-sectional study employed among 86 children with CKD. Data was collected from medical records and by taking history and physical examination of CKD children receiving follow-up care in the pediatric renal clinic using a pre-tested structured checklist. Statistical software Epi Info (7.2.5.0) was used for data entering and (SPSS 26 version) was employed for data analysis clearance. For variables that were statistically significant, descriptive statistics, ordinal logistic regression statistical analysis was used. Data was presented with frequency, percentage, and tables.

Result: Out of the 88 children with chronic kidney disease who were chosen for the study; the questionnaire was completed for 86 children, yielding a response rate of 97.7%. About 36.2% of patients were in the active age group of >10 years, and 37.2% of children were in the 5–10-year age range. Males outnumbered females, with a male-to-female ratio of 1.61:1. Among a total 86 children with CKD, 44.2% had stunting, and about 45.3% had wasting. Monthly income of the family, duration CKD from diagnosis, address (residence where the child live) and presence of comorbidity were strongly associated with malnutrition. The longer the duration illness the higher the risk of development of malnutrition with respective -14.5(95% CI: -16.564, -12.468, p-value= 0.000).

Conclusion: Malnutrition was seen in a considerable portion of our children with CKD, Malnutrition status was strongly associated with their age, gender, place of residency(address), caregivers' income, duration of illness and presence of associated comorbidity. Standard guideline needs to be prepared to diagnose and manage malnourished children with CKD.

Keywords: malnutrition, CKD, children, stunting

Contents

Acronyms and abbreviations

AAU--Addis Ababa University

BMI-- body mass index

CHS--College of Health Sciences

CKD -- chronic kidney disease

CAKUT- - congenital anomaly of kidney and urinary tract

EMDHS--Ethiopian Mini Demographic and Health Survey

ESRD- - end stage renal disease

GFR--Glomerular filtration rate

KDIGO- - kidney disease improving global outcome

SAHS--School of Allied Health Sciences

SPH--School of Public Health

SoM-- School of Medicine

SoP--School of Pharmacy

TASH- - Tikur Anbessa Hospital

SDS—standard deviation score

TSFT—Total skin fold thickness

UTI - -urinary tract infection

HRQoL-- health-related quality of life

WHO—World Health Organization

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1 Introduction

1.1 Background

Chronic kidney disease is kidney damage or glomerular filtration rate (GFR) <60 mL/min/1.73 m^2 for 3 months or more, irrespective of cause, resulting from a permanent, irreversible destruction of nephrons (1).

It is well known that malnutrition is a dangerous and frequent complications of chronic kidney disease (CKD) and that it raises the risk of morbidity and mortality in young patients. Patients with advanced chronic kidney disease (CKD) may experience malnutrition as a result of reduced food intake (mostly from anorexia), impaired intestinal absorption and digestion, and metabolic acidosis. Chronic uremic milieu can create metabolic stress besides causing nutrition-specific manifestations such as edema, stunting, reduced appetite, and muscle wasting (1, 2).

Growth failure is a major complication of children with chronic kidney disease (CKD). Poor growth is a marker of disease severity and is associated with significant morbidity and mortality. Poor growth in children with CKD, which is a marker of disease severity, is associated with significant morbidity and mortality. Poor nutritional intake is a common concern in children with CKD, and this often leads to severe growth retardation. Maintaining adequate nutrition and normal body composition is important for patients with chronic kidney disease (CKD) as well as those with end-stage renal disease (ESRD) (3).

Many factors can contribute to malnutrition that exacerbates kidney disease, such as insufficient food intake, nephrotic syndrome-related protein and other micro- and macronutrient loss through the urine, dialysate loss, coexisting conditions that cause hyper-catabolism, uremia, metabolic acidosis, and endocrine disorders like insulin resistance, hyperglucagonemia, and secondary hyperparathyroidism (4).

An essential component of treating patients with chronic kidney disease (CKD) is evaluating their nutritional status. Although it is a challenging notion to describe, maintaining a normal pattern of development and body composition through the consumption of the right kinds and amounts of food is probably the best way to define sufficient nutritional status. The difference between mild-to-moderate malnutrition and appropriate nutrition is unclear, despite the ease with which severe malnutrition may be identified. In order to differentiate between children who are properly and

insufficiently fed, the World Health Organization suggests using a cutoff point that is two standard deviations below the sex and age specific medians for weight-for-age, height-for-age, and weight-for-height published by the National Center for Health Statistics (5).

A major shift occurs in the needs and utilization of certain nutrients as chronic kidney disease (CKD) progresses. Patients with renal illness are ultimately more vulnerable to nutritional and metabolic disorders as a result of these alterations. For the best possible care of patients with chronic kidney disease (CKD), it is crucial to comprehend the relevant nutritional principles, the available techniques for evaluating nutritional status, determining patient-specific dietary needs, and preventing or treating potential or ongoing nutritional deficiencies and derangements. In children with kidney diseases, a comprehensive assessment requires multiple evaluations including dietary evaluation and anthropometric and biochemical measurements. task force (6 &7).

One of the main objectives of managing pediatric CKD is normal growth and development. Careful monitoring of nutritional status is necessary since reaching these goals depends on having an acceptable nutritional status. There is no one assessment that can really capture the complexity of nutritional status. When taken as a whole, several measurements are needed to provide a comprehensive and accurate picture of nutritional status. Children's growth metrics are very significant, and they should be monitored precisely with established procedures and calibrated equipment (8).

This study will evaluate the nutritional status and associated factors of children with chronic kidney disease (CKD) and examine the relationship between anthropometric measurements.

1.2 Statement of problem

One significant factor influencing the morbidity and mortality linked to chronic kidney disease (CKD) in children is their nutritional state at the start of treatment. Thus, evaluating nutritional status is a crucial component of providing treatment for children with chronic kidney disease. In Ethiopia there is a dearth of information about malnutrition among children with chronic renal disease (9).

A Greek study found that, depending on the assessment marker, 20–30% of children with advanced stages of chronic kidney disease were malnourished, 37% were at increased risk of malnutrition as indicated by their PeDiSMART score, and 26% had an inadequate energy intake (10).

According to a study conducted in Egypt, the more severe the development disruption, the sooner kidney disease beginning occurs in children receiving hemodialysis for chronic renal failure. Therefore, deficiencies may be corrected by identifying malnutrition and growth anomalies and acting quickly to address them with nutritious supplements (11).

An institution-based cross-sectional study carried out among adult patients in selected Addis Ababa hospitals revealed that, despite the paucity of research on the pediatric population, 43.1% of study participants had a measured BMI of less than 18.5. Undernutrition is well documented to be a prevalent comorbidity in individuals with chronic kidney disease, which accelerates the illness's development to end-stage renal disease, renal dysfunction, and the associated morbidity and mortality (12).

There is no research or data available in our country that demonstrates the nutritional status of children with chronic renal disease. Therefore, this study was carried out to evaluate the nutritional status and associated factors among children with chronic kidney disease in TASH, Addis Ababa, Ethiopia.

1.3 Significant of the study

Chronic kidney disease (CKD) is a major public health problem because to its high cost, associated morbid conditions, and malnutrition. Even in industrialized countries, there is considerable morbidity and death from CKD. Malnutrition can occur in patients with severe chronic kidney disease (CKD) due to decreased food intake (mostly from anorexia), poor intestinal absorption and digestion, and metabolic acidosis.

Research on chronic kidney disease (CKD) among children was scarce in our countries, and none of it particularly addresses malnutrition in young CKD patients. Thus, in the pediatric renal clinic at Tikur Anbessa Specialized Hospital, this study was conducted to assess the nutritional status and associated factors among children with chronic kidney disease (CKD).

2. Literature review

It was strongly recommended by the Pediatric Renal Nutrition Taskforce to weigh children with renal problems, measure their head circumference, height, weight, or body mass index (BMI), and weigh children under two years old in relation to their length. Depending on the evaluation marker utilized, twenty to forty percent of their patients were malnourished. The most important characteristics that determined malnutrition in the research group were age at diagnosis, GFR, MUAC, and real protein consumption (10,7).

Descriptive cross-sectional study carried out on 50 child attending Pediatric Nephrology Clinic at Al-Hussein university Hospital for children aged 2 to 18 years used different parameters: full history taking including dietary intake, full medical examination including anthropometric measurements, and laboratory investigations including complete blood count, serum calcium, phosphorus, and serum albumin (13).

Growth of patients with CKD is markedly affected despite of adequacy of their caloric intake. the longer the duration of hemodialysis, the more severe the affection of growth parameters (13).

In various studies, an organized questionnaire for the interview contained the following: a nutritional assessment; biosocial information about the child's name, age, sex, place of residence, and uremic symptoms; and a physical assessment sheet that assessed the child's overall appearance as well as functional abilities, such as the health of their skin, hair, eyes, mouth, and muscles showed that, most of the children in the study had lower-than-normal height, weight, BMI, MAC, and TSFT values (14, 15).

From other studies, biochemical analyses using data from the child's medical records, including measurements of serum calcium and phosphorus in mg/dl, serum potassium and sodium in mEq/L, serum albumin level in g/L, urea in mg/dl, creatinine in mg/dl, hemoglobin in g/dl, and random blood sugar in mg/dl were used in malnutrition assessment in children with CKD. The majority of the children in the study had lower-than-normal height, weight, BMI, MAC, and TSFT. Other findings included dietary intake survey, feeding pattern assessment using the 24 hours recall method, appetite, likes, and dislikes, as well as the amount and type of snacks consumed revealed that the majority of studied children had height, weight, BMI, MUAC, TSFT less than normal.

Anthropometric and appetite measurements were more useful in the diagnostic process than biochemical criteria (14,16).

According to the 2019 Ethiopian Mini Demographic and Health Survey (EMDHS) report, 37%, 21%, and 7% of under-five children were stunted, underweight, and wasted, respectively in the general population and presence of comorbidities (CKD and congenital heart disease), will rise. the burden of malnutrition (17,18).

2.1 Patterns of malnutrition in children with CKD

A study in Al-Hussein university revealed that; weight was the most affected anthropometric parameter, as 70% of the patients were < 5th percentile (mean 21.3 ± 9.6), In addition the body mass index of 38% of the patient were < 5th percentile, while only 2% of the patient were > 50th percentile. The BMI ranged from 8.9 – 23.4 (mean 15.04 ± 1.9). This retardation was significantly related to duration of CKD (13).

A different study conducted in Egypt's Cairo on the nutritional status of children receiving hemodialysis for chronic renal failure found that height was the most anthropometric parameter that was affected, with 83.3% of the patients being stunted (height z-below -2). While in a study conducted in Saudi Arabia, nearly 60% of the participants had moderate to severe malnutrition, and none of the participants were overweight or obese (13,15).

The prevalence of growth retardation was much higher in late stages of CKD; the mean caloric deficit from recommended daily allowance was −40.33% for calories, +6.2% for proteins, and −10.51% for fats. and the diet was highly deficient in iron (mean 48.9% deficit), calcium (mean −22.2%) and had excess phosphates (mean 18.3%). this is ascribed as a result of a progressive decrease in intake of nutrients in advanced stages of CKD (15,19).

According to Iranian research on the evaluation of growth impairment in children with chronic kidney disease (CKD), the mean height SDS in the pubertal group was greater than in early childhood but lower than in the pre-pubertal phase, and 45% of patients in all groups were malnourished (20).

2.2. Factors affecting malnutrition status of children with CKD

Numerous academic studies have shown that malnutrition frequently results in delayed development and body mass index (BMI), both of which have been linked to increased rates of

illness and mortality in children. Furthermore, it is well accepted that a variety of factors, including inadequate caloric intake, uremic toxicity, anemia, and metabolic and endocrine abnormalities, are the main causes of development issues and cachexia in children with CKD. Inflammation was only connected to malnutrition in late stages 2-4 of chronic kidney disease, although being prevalent. Hormonal influences on Body Composition in Children with Chronic Kidney Disease studied at Montefiore Hospital suggests that the effects of inflammatory cytokines and hormones like ghrelin and leptin play a role in the development of malnutrition in CKD, which is one of the most important factors in the causes of malnutrition (16,21).

Malnourished patients with chronic kidney disease (CKD) had significantly higher rates of hospitalization and re-admission than non-malnourished controls in a nationally representative cohort study conducted in Taiwan. Additionally, the cumulative medical costs for outpatient and emergency visits were significantly higher among all malnourished CKD patients. When comparing malnourished patients with mild (62.9%), moderate (59.6%), or severe (43.6%) CKD to non-malnourished patients, the total medical expenses were likewise greater (22).

As anticipated, children with CKD had a much greater rate of anemia (63%), and malnutrition affected around 47.6% of the children. When assessing the dietary condition of children with chronic kidney disease (CKD), anthropometric measurements, biochemical parameters, residual renal function, and inflammatory variables are significant considerations (19,23).

A Tanta University Hospitals, Pediatric Nephrology Unit study carried out in Egypt found that the majority of children with chronic kidney disease (CKD) displayed abnormal eating patterns, sleep disturbances, a reduction in physical activity on a daily basis, poor academic performance, mood swings, deteriorating social relationships, and overall psychosocial decline. According to many research, fluid overload is a significant contributing factor to the misunderstanding of nutritional assessment measures in children with chronic kidney disease. The interpretation of some anthropometric parameters may also be compromised by abnormalities in the distribution of lean and fat tissue (24,25).

According to the CKD stages, the upper-middle-income group experienced 7% malnutrition in Stage III, 14% in Stage IV, 18% in Stage V, and 68% in Stage V-D; the low-income group experienced 10% malnutrition in Stage III, 26% in Stage IV, 40% in Stage V, and 93% in Stage V-D. This information was gathered from an Indian multicenter study on the status of malnutrition

in Chronic Kidney Disease Stages I–V-D from various socioeconomic groups. When the severity of malnutrition was categorized by CKD stages, it was shown that low-income groups had greater rates of malnutrition in the progressive phases of CKD than high-income groups did (26). Research conducted in Uganda found that the most common etiologies were glomerulonephritis (17%), congenital abnormalities of the urinary tract (CAKUT) (19%), and nephrotic syndrome (56%). The study also found that the total HRQoL was considerably poorer. Advanced CKD stages 3b–5, primary caregiver status other than parent, poor vitamin D, and anemia were all associated with worse HRQoL (19, 27).

Conceptual framework

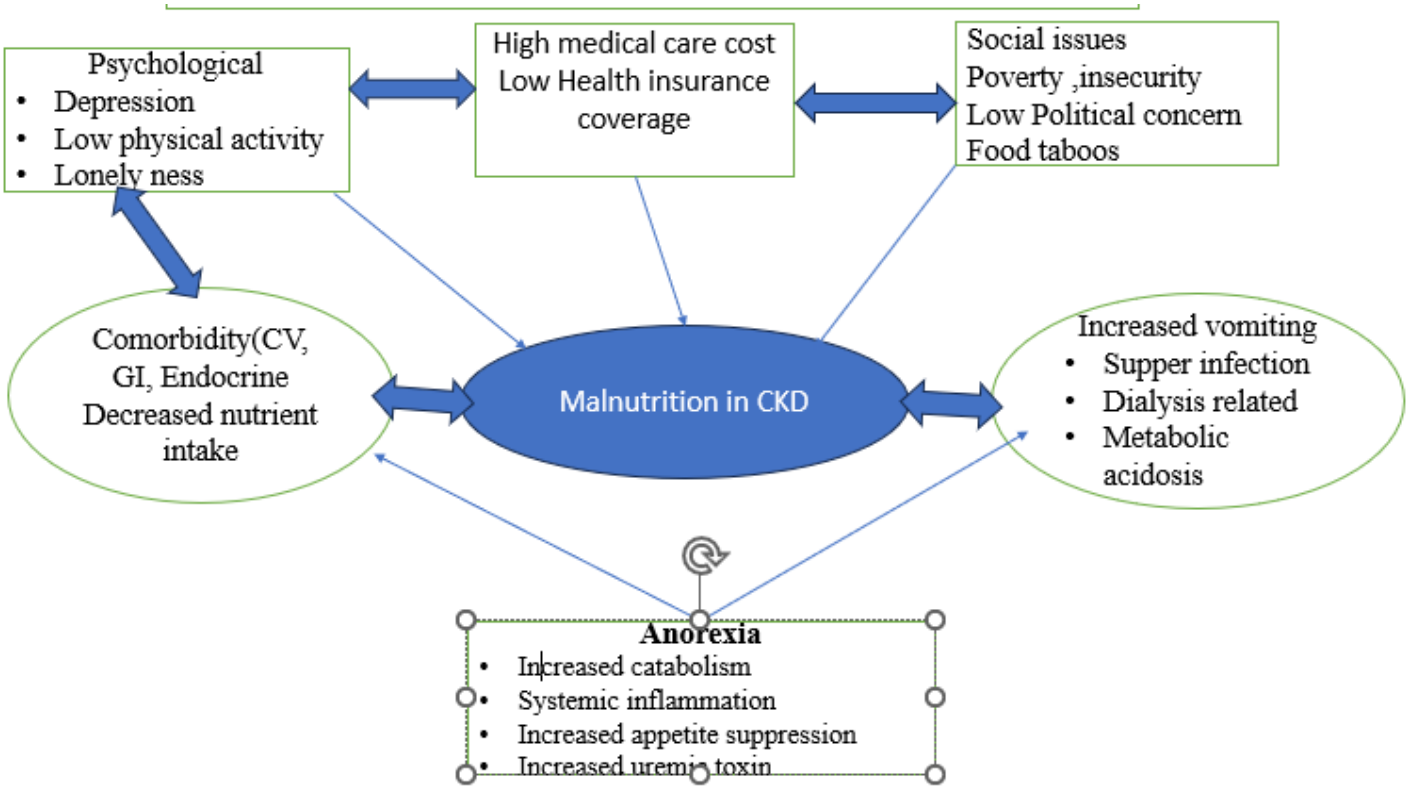

Figure 1 Conceptual frame work from different literatures (9,12,20, 22,26)

3. Objectives

3.1 General Objective

To evaluate the nutritional status and associated factors among children with CKD at the Pediatric Renal clinic at Tikur Anbessa Specialized Hospital

3.2 Specific objectives

1) To assess the nutritional status of children with CKD at the Pediatric Renal Clinic at Tikur Anbessa Specialized Hospital from September 2024 to January 2025.

2) To describe factors associated with the nutritional status of children with CKD at the pediatric renal clinic at Tikur Anbessa Specialized Hospital from September 2024 to January 2025.

4.Methods

4.1. Study Area and Setting

The study was conducted at the Tikur Anbessa Specialized Hospital (TASH), located in Lideta sub-city of Addis Ababa, the capital city of Ethiopia. The College of Health Sciences (CHS) of Addis Ababa University (AAU) is a professional health sciences college that was established in 2009–2010 after being reorganized from many health institutions under one roof. The CHS is composed of one teaching hospital and four schools. The four institutions are the School of Allied Health Sciences (SAHS), School of Public Health (SPH), School of Medicine (SoM), and School of Pharmacy (SoP). The SAHS offers professional training in medical laboratory technology, nursing, and midwifery. Tikur Anbessa Specialized Hospital (TASH) is the name of the college's teaching hospital.

TASH is the sole tertiary referral hospital in the country, with about 700 beds. There are around 22 specialist education programs offered by TASH; the most are offered there, while the remainder are offered at other hospitals throughout Addis Abeba. The hospitals Menelik II, Zewuditu Memorial, Sent PETER Comprehensive, ALERT Comprehensive, Gandi Memorial, and others, along with a few health facilities, are among them.

The pediatric and child health department of TASH includes the pediatric renal clinic as one of its pediatric health care units. For the purposes of kidney disease diagnosis, treatment, and prevention, it acts as Ethiopia's pediatric nephrology. TASH is the main teaching hospital for the College of Health Science at Addis Abeba University. Highly trained undergraduate and graduate medical students, dentists, radiologists, and other allied health science professionals get instruction in all disciplines there. The study was conducted from September 1, 2024, until January 30, 2025.

4.2 Study design and period

A cross-sectional study design was employed from September to January 2024/2025.

4.3 Population

4.3.1 Source population

All children who had a follow-up at Tikur Anbessa Specialized Hospital (TASH) renal clinic in 2024/2025.

4.3.2 Study population

The study population is all children with CKD, who had follow-up at Tikur Anbessa Specialized Hospital renal clinic in 2024/2025.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All children with CKD, who had follow-up at Tikur Anbessa Specialized Hospital during the data collection period was included in the study.

4.4.2 Exclusion criteria

Those children who are critically ill during the data collection period and had difficulty in taking history and physical examination.

4.5 Sampling technique and sample size determination

4.5.1 Sampling technique

Purposive sampling technique was employed

4.5.2 Sample size determination

Sample size of the study was calculated using Taro Yamane formula (1967) for a small population such as this study. To this end, a final sample size of 88 was determined as follows;(40).

$$n = \frac{N}{1 + N(e^2)} = \frac{112}{1 + 112(0.05^2)} = \frac{112}{1 + 112(0.0025)} = 88$$

Where: n = final sample size

N= target population size

e = margin of error (5%)

4.6. Data Collection Instrument and Process

4.6.1 Data collection instrument

A pre-tested a structured check list was used to collect data. The checklist was adapted from different literatures and modified according to this study variables and objectives. This checklist was prepared in English as medium of education.

Medical records (patient charts and log books) of CKD children receiving follow-up care in pediatric renal clinics were the source of data collection at TASH. Trained medical interns were gather the data, and the primary investigator overseen the procedure. The primary investigator oversaw the data collection process on a daily basis and ensured that it was thorough. The information was gathered using a standardized check list that includes history, anthropometry, significant investigations, and demographic information on children with renal illness. There was no need to convert the check list into Amharic because the data collectors were medical experts familiar with the research variables. Prior to beginning the real data gathering process, the checklist was pretested

4.6.2 Data Collection process

Data was collected by asking caregivers, measuring anthropometric and from chart review by trained data collectors

4.7 Operational definitions

Malnutrition: Malnutrition is a form of undernutrition caused by a decrease in food consumption and/or illness resulting in bilateral pitting oedema and/or sudden weight loss (12)

Renal disease; any disease which affects renal system structurally or functionally, can be renal or extra renal cause (4)

CKD (Chronic renal disease): decreased renal function which stays more than 3months defined by eGFR <60ml/m2 (4)

MUAC (mid upper arm circumference): Low MUAC is an indicator for wasting. Based on WHO age specific definitions and standards (5)

Wasting: Wasting is a form of acute malnutrition. It is defined by a MUAC, WFL/H and BMI for age < -2 z-score (5)

Stunting: Stunting, or chronic undernutrition, is a form of undernutrition and presents as low height-for-age (HFA). It is defined by an HFA z-score below two SDs of the median (WHO standards.

Low hemoglobin level was less than 13g/dl

Low serum Vitamin D level less than 30ng/ml

High serum phosphorous level was defined when level higher than 6.5mg/dl

Low serum albumin level was defined as less than 3.5mg/dl

High serum creatinine level was greater than 0.5mg/dl

High blood urea level was higher than 20mg/dl

4.8 Research Variables

4.8.1 Dependent variables

The dependent variables of this study were malnutrition defined by HFA, WFL/H, HC, MUAC and BMIFA of children with in TASH pediatric Renal clinic in 2024/25.

4.8.2 Independent variables

In order to evaluate the association between dependent variables and other socio-demographic variables, the study used the following explanatory variables which includes, Age, sex, address, religion, duration of the illness, caregivers' educational status, caregivers' occupation, caregivers' monthly income, cost per clinic visit, associated comorbidity, and Stage of CKD.

4.9. Data processing and management

During the data collecting period, the acquired data was coded and examined for consistency and completeness. Epi Info version 7.2.5.0 software was used to enter the data after the entire set of data had checked for redundancy

4.10. Data Analysis

Data was collected by checklist and was entered, cleaned and analyzed using SPSS statistical software version 26. Data was cleaned by running frequencies of all the variables to check for incorrect coding and missing values. Descriptive and summary statistics was carried out. Measure of associations of the dependent and the independent variables with bivariate and multivariate analysis was carried out.

Data quality assurance

A well-designed data collection instrument was constructed prior to the actual data collection period, and the principal investigator kept careful eye on the data gathering procedure to guarantee the quality of the data. To guarantee clarity, phrasing, logical sequencing, and skip patterns, the checklist was pretested two weeks before the actual data collecting period among a similar research population, which accounted for around 5% of the study population at TASH renal clinic.

On 5% of the sample (n = 88), Cronbach's Alpha was used to assess reliability. The sufficiency was determined by reliability.

4.12. Ethical Clearance

The research and ethical committee of Pediatrics and Child health Department provided the clearance. The purpose of the study was explained to the chief executive director of TASH, and permission was pursued before beginning data collection. Written informed consent was obtained from each participant care givers and their ‘anonymity and confidentiality were kept.

4.13. Dissemination of Findings

At the department of pediatric and child health, school of medicine, college of health science, Addis Abeba University, the report of the findings will be defended after the study had finished. The advisor of the thesis at Addis Abeba University's graduate school will get it. The outcome will be shared through workshops, seminars, and publication in a high impact journal on a global scale.

5 Result

5.1 Sociodemographic characteristics of children with CKD

Out of the 88 children with chronic kidney disease who were chosen for the study; the questionnaire was completed for 86 children, yielding a response rate of 97.7%.
36.2% of patients were in the active age group of >10 years, and 37.2% of children were in the 5–10-year age range. Males outnumbered females, with a male-to-female ratio of 1.61:1

Most children with CKD were from Addis Ababa and Oromia, more than 60% of children were Orthodox Christians and about 30% were Muslims in religion. More than 60% were eligible for education and the rest were not, and from those, more than 37% miss less than 4 school days and about 19% miss 4-7 school days per month, while 9.3% discontinued their education.

About 37.2%, 33.7%, 29.1% of caregivers were at primary school, secondary school and graduate level educational status respectively. About 31.4%, 25.6%,12.8% of caregivers were, government employee, farmer, daily laborer respectively. Most care givers have less than 7000 ETB monthly income, and only 28/86(32.6%) have above 10000ETB monthly income. For about 58/86 (68%) of children have more than 2000ETB average cost per clinic visit. (Table 1).

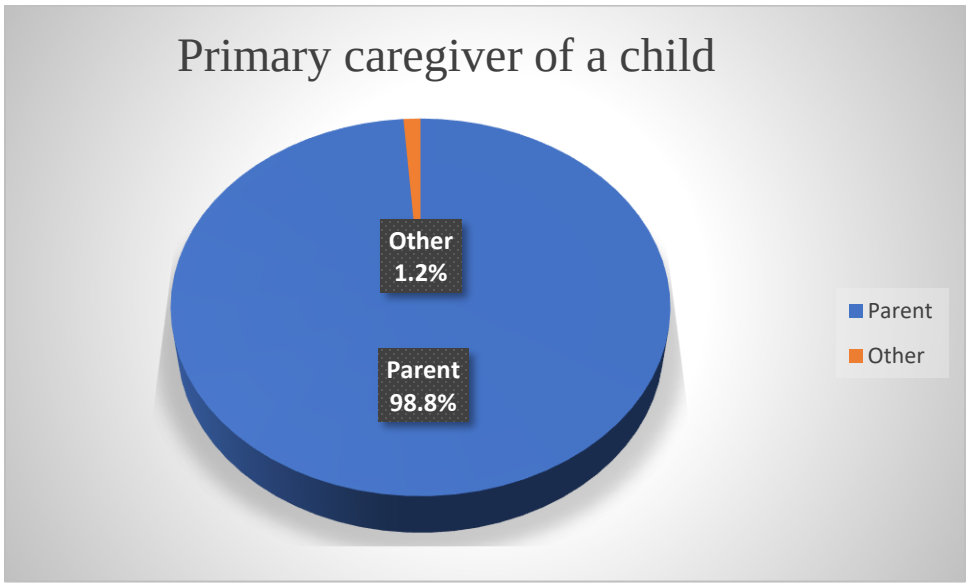

Figure 2: Percentage of primary caregivers for children with CKD in Addis Ababa University specialized Hospital 2024

Table 1: Background characteristics of children with CKD in Tikur Anbessa Specialized Hospital 2024/25

Background characteristics		Frequency	Percentage
Age	<1 years	1	1.2
	1-3 years	12	14.0
	3-5 years	13	15.1
	5-10 years	32	37.2
	>10 years	28	32.6
Sex	Male	53	61.6
	Female	33	38.4
Address	Addis Ababa	31	36.0
	Oromia	31	36.0
	Amhara	7	8.1
	Southern Nations and peoples	10	11.6
	Afar	2	2.3
	Somali	3	3.5
	Others	2	2.3
Religion	Orthodox	52	60.5
	Muslim	24	27.9
	Protestant	9	10.5
	Other	1	1.2
Caregivers' education	Primary school	32	37.2
	Secondary school	29	33.7
	Graduate	25	29.1
Occupation of care givers	Farmer	22	25.6
	G/employee	27	31.4
	Daily laborer	11	12.8
	Merchant /self-employee/	10	11.6
	Private employee	16	18.6
Monthly income of caregivers	<5000ETB	18	20.9
	5000-7000ETB	18	20.9
	7000-10000ETB	22	25.6
	>10000ETB	28	32.6
Average cost per clinic visit	1000-2000ETB	28	32.6
	>2000ETB	58	67.4
No. of missed school days per month	<4 days	32	54.2
	4-7 days	16	27.1
	8 days and above	3	5.1
	Discontinued school	8	13.6
	NA	27	…

Source: Author's computation using SPSS 26 version, 2025

5.2 Anthropometric evaluation

Among a total 86 children with CKD having follow-up at TASH renal clinic,38(44.2%) was stunted of which 27/86 (31.4%) were having sever stunting while 11/86(12.8%) had moderate stunting. WFH was not applicable (NA) in about 68.6% of study populations because of their age is above5 years. From a total of children with CKD for whom WFH is applicable and measured, only 1/27(3.7%) of under five children with CKD had severe acute malnutrition and 7/27(25.9%) were moderately acute malnourished while the rest above 19/27(70%) were normal. According to Mid-upper arm circumference (MUAC), about 10/86(11.6%) were severely acute malnourished and 29/86(33.7%) were moderately acute malnourished.

About 59 children (68.6%) were above 5 years old and head circumference (HC) measurement was not done (NA). From a total 27 children with CKD, head circumference was done and among them 25/27(92.6%) were normocephalic and 2/27(7.4%) of children were macrocephalic. There is no microcephalic child. As one of anthropometric measurements, 7/86(8.1%) and 13/86(15.1%) of children were severely wasted and wasted respectively while 66/86(76.7%) had normal BMI. Only 2(2.3%) of children with CKD have significant weight loss in the past 3 months Table (2)

Table 2: Anthropometric evaluation of children with CKD in Tikur Anbessa Specialized Hospital 2024/25

Anthropometric variables		**Frequency**	**Percentage**
Height for age	Severely Stunted Moderately stunted Normal	27 11 48	31.4 12.8 55.8
Weight For Height	Sever acute malnutrition Moderate acute malnutrition Normal NA	1 7 19 59	3.7 25.9 70.4 --
Mid-upper arm circumference	Severe acute malnutrition Moderate acute malnutrition Normal	10 29 47	11.6 33.7 54.7
Head Circumference	Normocephalic Macrocephaly NA	25 2 59	92.6 7.4 --
Body mass index for age	Severely wasted wasted Normal	7 13 66	8.1 15.1 76.7

Source: Author's computation using SPSS 26 version, 2025

More than 95% of study population has no symptoms in the past 3 months and among symptomatic patients 4/86(4.7%) and 2/86(2.3%) had decreased appetite and Significant weight loss within 3 months respectively. Among different causes of CKD 25/86(29.1%), 23/86(26.7%), 21/86(24.4%), and 10/86(11.6%) were neurogenic bladder, posterior ureteral valve/PUV/, other congenital urinary tract disorders and glomerulonephritis respectively.

Most children with CKD are stage 2, stage 3, and stage 4 with 33/86(38.4%), 36/86(41.9%) and 11/86(12.8%) respectively. About 24/86(27.9%) of children with CKD had associated comorbidities while less than 4/86(5%) of children had history of dialysis

Table 3: Symptoms of children with CKD in Tikur Anbessa Specialized Hospital 2024/25

CKD manifestations		**Frequency**	**Percentage**
Patient has any symptoms	Yes No	4 82	4.7 95.3
Decreased appetite	Yes No	4 82	4.7 95.3
Significant weight loss within 3 months	Yes No	2 84	2.3 97.7
Causes of CKD	Posterior urethral valve /PUV/ Neurogenic bladder Glomerulonephritis Nephrotic syndrome Other congenital urinary tract disorder SLE Metabolic causes Others	23 25 10 2 21 2 2 1	26.7 29.1 11.6 2.3 24.4 2.3 2.3 1.2
Stages of CKD	stage 1 stage 2 stage 3 stage 4 stage 5	1 33 36 11 5	1.2 38.4 41.9 12.8 5.8
History of dialysis	Yes No	4 82	4.7 95.3
Presence of comorbidity	Yes No	24 62	27.9 72.1

Source: Author's computation using SPSS 26 version, 2025

About 28/86(32.6%) of study population had anemia with hemoglobin <11g/dl and other 30/86(34.9%) of children had hemoglobin level of 11-13g/dl the rest 28/86(32.6%) had a hemoglobin level of 13g/dl and above. For about 69/86(80.2%) children with CKD serum albumin was not determined on the other hand from children for whom serum albumin was determined about 10/17(58.8%) had low serum albumin level.

Serum creatinine level and serum urea (BUN) level was higher for about 85/86(99%) and 81/86(94.2%) of study population respectively. Serum phosphorous and serum vitamin D level are not determined for about 42/86(48.8%) and 48/86(55.8%) of study population respectively.

From sample population for whom serum vit D level was determined, 7/38(18.4%),22/38(57.9%) was Vit D deficient and Vit D Insufficient respectively. On the other hand, for whom serum phosphorous level was determined, 9/44(20.5%) had higher phosphorous level and about 35/44(79.5%) had normal serum phosphorous level (Table 4).

Table 4: Laboratory evaluation of children with CKD in Tikur Anbessa Specialized Hospital 2024/25

Laboratory variables		**Percentage**	**Frequency**
Hemoglobin/Hematocrit	<11g/dl 11-13 g/dl 13g/dl and above	28 30 28	32.6 34.9 32.6
Serum albumin	Low normal NA	10 7 69	58.8 41.2 --
Serum creatinine	Elevated creatinine Normal creatinine	85 1	98.8 1.2
Serum urea/BUN/	Elevated Normal	81 5	94.2 5.8
Serum Vit D level	Deficient Insufficient Normal NA	7 22 9 48	18.4 57.9 23.7 --
Serum phosphorous level	High Normal NA	9 35 42	20.5 79.5 --

Source: Author's computation using SPSS 26 version, 2025

5.3 Association of sociodemographic characteristics with malnutrition

Association was done using ordinal regression because this study variables were multiple and categorical. Test of parallel line was done and not significant which shows that ordinal logistic regression was suitable for this study analysis

As shown in the table 5 below, duration of illness is significantly associated with stunting which is measured by HFA -14.5(95% CI: -16.564, -12.468, p-value= 0.000). Being ill for short duration is not at increased risk the development of stunting, as duration of illness increased severity of chronic malnutrition (stunting) increased.

Family/caregivers' monthly income is also associated with chronic malnutrition or stunting. In this study Children whose caregiver's monthly income lower than 10,000ETB have increased risk of stunting compared to children whose caregiver monthly income is more than 10,000 ETB with respective -3.53(95% CI: -6.938, -.122, p-value= 0.042) (Table 5).

Table 5: Association of sociodemographic characteristics with HFA

							95% Confidence Interval	
	Estimate	**OR**	**Std. Error**	**Wald**	**Df**	**P value**	**Lower Bound**	**Upper Bound**
Severely stunted	-13.328	0.000	9729.854	0.000	1	0.999	-19083.491	19056.836
Moderately stunted	-11.908	0.000	9729.854	0.000	1	0.999	-19082.072	19058.256
Age								
< 1 year	20.751	102.715	8446.599	.000	1	.998	-16534.279	16575.781
1-3 year	.783	2.187	1.575	.247	1	.619	-2.304	3.869
3-5 year	-1.313	0.269	1.388	.895	1	.344	-4.034	1.408
5-10 year	2.096	8.133	1.102	3.616	1	.057	-.064	4.256
>10 year	0a		.	.	0	.	.	.
Male	0.677	1.969	.973	.485	1	.486	-1.230	2.584
Female	0[a]		.	.	0	.		
Addis Ababa	-22.211	0.000	4829.593	.000	1	.996	-9488.039	9443.616
Oromia	-19.876	0.000	4829.592	.000	1	.997	-9485.703	9445.951
Amhara	-24.543	0.000	4829.593	.000	1	.996	-9490.371	9441.285
SNNS	-18.090	0.000	4829.593	.000	1	.997	-9483.917	9447.738
Afar	.018	1.019	9729.851	.000	1	1.000	-19070.139	19070.175
Somalia	-19.625	0.000	4829.593	.000	1	.997	-9485.453	9446.203
Others	0a		.		0	.	.	
Orthodox	4.452	85.808	2.901	2.355	1	.125	-1.234	10.138
Muslim	.591	1.806	3.059	0.037	1	.847	-5.405	6.587
Protestant	1.826	6.208	3.135	0.339	1	.560	-4.318	7.970
Others	0a				0	.		
Primary	-.177	0.838	1.896	.009	1	.926	-3.894	3.539
Secondary	-1.744	0.175	1.445	1.456	1	.227	-4.576	1.088
Graduate	0a		.		0			
Farmer	2.163	8.695	2.188	.977	1	.323	-2.125	6.450
G/employee	-.446	0.640	1.591	.078	1	.779	-3.564	2.673
Daily laborer	1.372	3.941	1.889	.527	1	.468	-2.330	5.073
Merchant	-.300	0.741	2.069	.021	1	.885	-4.355	3.755
Private employee	0a		.	.	0			
income<5000ETB	-4.839	0.008	2.477	3.817	1	.051	-9.694	.015
5000-7000ETB	-3.530	0.029	1.739	4.121	1	.042	-6.938	-.122
7000-10000ETB	-1.328	0.265	1.385	.919	1	.338	-4.042	1.387
>10000ETB	0a		.	.	0	.	.	.
Illnessduration<1yr	-16.335	0.000	2.624	38.763	1	.000	-21.477	-11.193
Illnessduratio1-3yr	-14.516	0.000	1.045	192.996	1	.000	-16.564	-12.468
Illnessduration3-6yr	-16.103	0.000	0.000	.	1	.	-16.103	-16.103
Illnessduration>6yr	0a				0			
CKD/stage=1	-8.484	0.000	8132.100	.000	1	.999	-15947.108	15930.140
CKD/stage=2	3.152	23.390	3.278	.925	1	.336	-3.272	9.577
CKD/stage=3	3.059	21.309	3.082	.985	1	.321	-2.981	9.099
CKD/stage=4	1.024	2.785	3.435	.089	1	.766	-5.709	7.757
CKD/stage=5	0a		.	.	0	.		
With comorbidity	-.970	0.379	0.379	.777	1	.378	-3.125	1.186
With out comorbidity	0a			.	0	.	.	.

Source: Author's computation using SPSS 26 version, 2025

Address of the child had a strong association with malnutrition which was measured by MUAC. Children with CKD who were from Oromia region were high likely to have malnutrition when compared to those children living in other places (Table 6).

As illustrated in table 6 below, duration of illness was also associated with malnutrition measured by MUAC. The longer the duration of illness the higher the risk of development of malnutrition with respective -26.3 (95% CI: -30.500, -22.120, p-value= 0.00). The other independent variable which was associated with malnutrition measured by MUAC in children with CKD was presence of comorbidity. So, children who was having associated comorbidity was at increased risk of development of malnutrition measured by MUAC 3.4 (95% CI: 0.923, 5.895, p-value= 0.007).

Malnutrition measured with WFH had no association with any of the independent variable and other sociodemographic variables as shown in (table 7).

Table 6: Association of sociodemographic characteristics with malnutrition measured by MUAC

							95% Confidence Interval	
	Estimate	**OR**	**Std. Error**	**Wald**	**Df**	**P value**	**Lower Bound**	**Upper Bound**
MUAC < -3 Z-score	16.810	0.000	10796.792	0.000	1	.999	-21144.513	21178.134
MUAC<-2 Z-score	21.202	0.000	10796.792	0.000	1	.998	-21140.122	21182.525
Age								
< 1 year	27.327	738062375552.770	8455.263	0.000	1	0.997	-16544.684	16599.338
1-3 year	0.028	1.029	1.279	0.000	1	0.982	-2.479	2.535
3-5 year	-1.076	0.341	1.230	0.764	1	0.382	-3.488	1.336
5-10 year	1.678	5.353	0.992	2.862	1	0.091	-.266	3.621
>10 year	0a				0			
Male	.703	2.019	.786	.799	1	.371	-.838	2.243
Female	0a		.	.	0	.	.	.
Addis Ababa	8.338	4179.268	3.303	6.371	1	.012	1.863	14.812
Oromia	9.588	14589.845	3.283	8.531	1	.003	3.154	16.022
Amhara	9.459	12826.292	3.666	6.659	1	.010	2.275	16.644
SNNS	11.840	138685.769	3.834	9.536	1	.002	4.325	19.355
Afar	25.842	167193456451.649	8455.265	.000	1	.998	-16546.172	16597.856
Somalia	12.135	186308.882	4.219	8.274	1	.004	3.867	20.404
Others	0a		.	.	0	.	.	.
Orthodox	-.362	0.696	3.663	.010	1	.921	-7.541	6.817
Muslim	-4.620	0.010	4.161	1.233	1	.267	-12.776	3.535
Protestant	-1.012	0.363	4.073	.062	1	.804	-8.995	6.971
Others	0a		.		0	.	.	
Primary	3.634	37.861	2.344	2.403	1	.121	-.961	8.229
Secondary	1.359	3.890	2.077	.428	1	.513	-2.712	5.429
Graduate	0a		.	.	0	.		
Farmer	-3.087	0.046	2.448	1.590	1	.207	-7.885	1.711
G/employee	1.684	5.386	2.322	.526	1	.468	-2.868	6.235
Daily laborer	3.730	41.691	2.374	2.469	1	.116	-.923	8.384
Merchant	1.636	5.133	1.748	.876	1	.349	-1.790	5.062
Private employee	0a		.	.	0	.	.	
income<5000ETB	1.177	3.243	2.533	.216	1	.642	-3.789	6.142
5000-7000ETB	-2.474	0.084	1.889	1.716	1	.190	-6.175	1.228
7000-10000ETB	.470	1.599	1.080	.189	1	.664	-1.646	2.586
>10000ETB	0a		.	.	0	.	.	.
Illnessduration<1yr	-26.310	0.000	2.138	151.458	1	.000	-30.500	-22.120
Illnessduratio1-3yr	-19.814	0.000	1.039	363.728	1	.000	-21.850	-17.777
Illnessduration3-6yr	-20.818	0.000	.000	.	1	.	-20.818	-20.818
Illnessduration>6yr	0a				0		.	
CKD/stage=1	21.557	2302465491.770	8455.263	.000	1	.998	-16550.453	16593.568
CKD/stage=2	-.560	0.571	2.450	.052	1	.819	-5.362	4.241
CKD/stage=3	.091	1.095	2.259	.002	1	.968	-4.337	4.519
CKD/stage=4	.280	1.323	2.371	.014	1	.906	-4.368	4.928
CKD/stage=5	0a		.	.	0	.	.	.
With comorbidity	3.409	30.233	1.268	7.224	1	0.007	0.923	5.895
With out comorbidity	0a				0			

Source: Author's computation using SPSS 26 version, 2025

Age and sex of the study population was strongly associated with malnutrition measured via BMIFA. Children who are in the age group of 5-10 years are more likely to have malnourished compared to those whose age group is >10 years with p-value and CI, (0.012) and 13.455 (95% CI: 2.963, 23.948) respectively. Sex is also strongly associated with malnutrition measured by BMIFA, here being male is at increased risk of developing malnutrition when compared to being female as described by p-value and CI, 0.038 and 8.329 (95%CI: 0.470, 16.188) respectively (Table 8).

Table 7: Association of sociodemographic characteristics with malnutrition measured by BMIFA

							95% Confidence Interval	
	Estimate	**OR**	**Std. Error**	**Wald**	**Df**	**P value**	**Lower Bound**	**Upper Bound**
[BMIFA = <-3Zscore	-156.809	0.000	2161.150	0.005	1	0.942	-4392.587	4078.968
[BMIFA =<-2Zscore	-151.878	0.000	2161.140	0.005	1	0.944	-4387.634	4083.879
Age								
< 1 year	-5.840	0.003	3.128	3.485	1	0.062	-11.971	0.291
1-3 year	-56.880	0.000	108.143	0.277	1	0.599	-268.836	155.076
3-5 year	13.455	697578.441	5.354	6.317	1	0.012	2.963	23.948
5-10 year	0a				0			
>10 year								
Male	8.329	4141.741	4.010	4.314	1	0.038	0.470	16.188
Female	0a				0			
Orthodox	22.817	8112916452.835	1470.608	0.000	1	0.988	-2859.523	2905.156
Muslim	-37.258	0.000	1471.922	0.001	1	0.980	-2922.172	2847.655
Protestant	-36.797	0.000	1471.921	0.001	1	0.980	-2921.710	2848.115
Others	0a				0			
Primary	-70.014	0.000	108.579	0.416	1	0.519	-282.824	142.796
Secondary	-73.567	0.000	108.580	0.459	1	0.498	-286.380	139.247
Graduate	0a				0			
Farmer	-142.253	0.000	233.570	0.371	1	0.542	-600.041	315.535
G/employee	-88.666	0.000	144.531	0.376	1	0.540	-371.942	194.610
Daily laborer	-47.890	0.000	111.411	0.185	1	0.667	-266.252	170.472
Merchant	15.814	7378402.989	36.495	0.188	1	0.665	-55.715	87.343
Private employee	0a				0			
Illnessduration<1yr	-98.295	0.000	115.885	.719	1	.396	-325.426	128.836
Illnessduratio1-3yr	-78.336	0.000	108.846	.518	1	.472	-291.671	134.999
Illnessduration3-6yr	-91.896	0.000	109.695	.702	1	.402	-306.894	123.102
Illnessduration>6yr	0a		.	.	0	.	.	.
With comorbidity	13.943	24573415716.826	36.338	0.433	1	0.510	-47.296	95.146
With out comorbidity	0a				0			

Source: Author's computation using SPSS 26 version, 2025

6 Discussion

Children with chronic kidney disease are at increased risk of malnutrition, timely recognition, diagnosis and intervention is essential for better outcome. The aim of our study was to assess the magnitude and associated factors of malnutrition among children with chronic kidney disease in Tikur Anbessa Specialized Hospital. In this study, 38/86(44.2%) had stunting as measured by HFA. This linear growth disturbance is in line with studies done in Ege University, Turkey to identify the prevalence and associated factors of growth failure and malnutrition in children with CKD (13,20,28).

Stunting in this study was higher when compared with Ethiopian mini-EDHS survey which showed 37% of children under age 5 were stunted (short for their age), this show children having CKD are at increased risk of stunting. This is explained by the population wide study will not give similar result with population having chronic illness. Stunting in our study was higher as compared with a study done on nutritional assessment among children with congenital heart disease at cardiac center Ethiopia, which showed stunting was 43% (18, 34,35).

This study was also in line with the overall country wide trained of Ethiopian childhood stunting and with a cross-sectional study done in Kenia on factors associated with early childhood stunted growth in a 2012–2015 birth cohort monitored in the rural Msambweni area of coastal Kenya (29). Which showed burden of childhood stunting in most sub-Saharan countries is among the common health issue in both acute and chronically ill children, in the result shown by different studies (20,30,31)

Numerous factors, such as metabolic acidosis, poor nutrition, renal osteodystrophy, sodium depletion, delayed sexual maturation, and anomalies of the growth hormone insulin-like growth factor 1 axis, can contribute to poor linear growth in children with chronic kidney disease (CKD). Every stage of development, from infancy to adolescence, can be hampered by chronic renal disease, which can lead to growth retardation. In this study different sociodemographic factors were evaluated for association among these, income of the family, duration CKD from diagnosis, address (residence where the child live) and presence of comorbidity were strongly associated with linear growth failure or stunting. (4,7,8,13).

Most studies recommended that regular nutritional intervention improved growth in children with renal insufficiency of all ages of CKD, this shows that low income and poor feeding are strongly associated in these studies even though not the aim of current paper. In this study because of the limited sample size, there was no discernible correlation between stunting and decreased appetite or its accompanying symptoms, such as nausea, vomiting, and changed taste, which can affect hunger and food intake. Deficits that influence growth can result from CKD's effects on the metabolism and absorption of several micronutrients, such as vitamin D, iron, zinc, and phosphorous. Another study done in Al-Azher University demonstrated that height was markedly affected in children with CKD, as 50% of the patients were short, and this is in line with current study (13).

Acute malnutrition measured by MUAC and BMI

When assessing a child's state of malnutrition, MUAC was another indicator utilized as an indication for the thickness of muscle and subcutaneous fat in the upper arm (25, 32). The relevance of MUAC in our study also showed that malnourished children had low levels of muscle and subcutaneous fat as well as body fat. The result of this study showed that about 39/86(45.3%) of the study population were moderately to severely acute malnourished as evaluated by MUAC. This is similar to study done and revised by clinical practice recommendations from the Pediatric Renal Nutrition Taskforce and a study in Hippokratio General Hospital, Aristotle University of Thessaloniki, Greece (7,25.33).

When the present study was compared to the general population's malnutrition, which revealed 7% of children under the age of five were wasted (thin for their height), much lower than the current study (45.3%). This indicates that children with chronic kidney disease were more likely to have wasting (34, 35). Acute malnutrition (wasting) in our study was higher as compared with a study done on nutritional assessment among children with congenital heart disease at cardiac center Ethiopia, which showed wasting was 41.3%.

MUAC was proposed as a PEW marker in pediatric patients (32). Muscle wasting is the main finding of PEW in a study by Arpana Iyengar and Robert H. Mak about Undernutrition/PEW and muscle Wasting in Children with CKD. As a result, a lower mid-arm circumference (MAC) was more common (41%), indicating that muscle wasting occurs before underweight occurrence. The same study found that the prevalence of poor growth was 42% overall, which is almost the same

as the prevalence of decreased muscle mass throughout all stages of CKD. This suggests that muscle wasting and poor growth typically occur at the same time (10, 16).

We have done association of sociodemographic and other dependent variables with MUAC, among which address/place of residency, duration of CKD and presence of associated comorbid illness were strongly associated. This result was similar with study done on Children who were on chronic dialysis which resulted moderate to severe malnutrition in more than 47.4% which is associated with the above sociodemographic characteristics. There was also another study done in Egypt which showed that Severe malnutrition measured by MUAC and BMI was strongly associated with prolonged duration of illness and poor protein intake which had similar outcome with the current study (11,16).

Another anthropomorphic parameter used in this study was BMI. The study revealed that about 23.2% of the study population was moderate to severely wasted as measured by BMI for age (BMIFA). Age and sex of study population was strongly associated with BMIFA, children under the age group of 5-10 years old was more than 8 times higher risk of developing malnutrition when compared to children older than 10 years. This could be explained by most of study samples 37.2% were under this age group and another explanation could be this is the age group at which most children develop symptoms and complications of CKD (3). Malnutrition level measured by MUAC and BMI had discordancy in the current study, may be due to most of our study subjects were stunted.

As it was stated in the result, WFH was not applicable (NA) in about 68.6% of study population because of their age is above 5 years. From a total of children for whom WFH is applicable and measured, about 29.6% of under five children with CKD have acute malnutrition (wasting) the rest above 70% were normal. Malnutrition measured with WFH has no association with any of the independent variable and other sociodemographic variables. This could be explained by sample population in this age group were small.

Another parameter assessed in this study was head circumference (HC), which was measured only for 27 (34.4%) children in the sample, among these about (7.4%) were macrocephalic. This can be explained by these macrocephalic children's samples could be associated with comorbidity possibly due to meningomyelocele with hydrocephalus. For the vast majority 59 children (68.6%) were above 5 years old and head circumference (HC) measurement was not done (NA).

Laboratory evaluations

As it was recommended predictor of malnutrition, serum albumin level was assessed in the current study and among study subjects for whom serum albumin level was determined, 10/17(58.8%) had low serum albumin level. This finding was higher than a study done at Al-Azher University, which showed 40% of study subjects were hypoalbuminemia. This much discordancy could be explained by in our study serum albumin was not determined in more than 80% of study subjects (8, 13,37).

In our study Serum phosphorous and serum vitamin D level were not found in patients' chart (not determined for about 48.8% and 55.8% of study population respectively. From study population for whom serum vit D level was determined, 29/38(76.3%) had low Vit D level. While for whom serum phosphorous level was determined, about 20.5% had higher phosphorous level. This finding was similar to hospital-based study done at King Abdulaziz University, which confirmed that vitamin D deficiency and insufficiency are more common in children with CKD than in healthy children. Other study also revealed that, children with mild to moderate CKD had a 28 % prevalence of 25OHD deficiency at enrollment, lower than current study. This significant discrepancy may be explained by the fact that over 76% of research participants had their blood vit D levels undetermined (4, 38,39).

7 Strength and limitation of the study

7.1 Strength of the Study

Assessment of malnutrition among children with CKD was not much studied and the current study can be used as background for the future researches.

This study used primary data's which makes the study more reliable

7.2 Limitation of the Study

Because there aren't many studies that assess malnutrition among CKD children, it's challenging to compare and discuss the results of this study. This study was done in TASH only as single center making sample small making generalization difficult. Presence of incomplete laboratory results for most of sample population made difficult to compare with other studies.

8 Conclusion and recommendation

8.1 Conclusion

The study's conclusions showed that malnutrition was seen in a considerable portion of our children with CKD. Linear growth was significantly affected as majority of children (44.2%) with CKD were stunted which showed chronic malnutrition measured by HFA and about (46.3%) children showed acute malnutrition measured by MUAC. Nutritional status was strongly associated with their age, gender, place of residency(address), caregivers' educational status, caregivers' income, duration of illness and presence of associated comorbidity.

8.2 Recommendation

The present study's conclusions lead to the following recommendations:

1. Moreover, I would advise TASH to prepare malnutrition management and assessment guideline specific for pediatric CKD patients.
2. Further investigation of malnutrition among children with CKD in multiple care centers would be ideal in order to address concerns and/or associated factors that were not covered in the current study.

Reference

1. KIDIGO 2023 clinical practice guideline for the evaluation and management of chronic kidney disease
2. Negussie AS, Tadesse AW. Predictors of undesirable treatment outcomes of severe acute malnutrition among inpatient children in Addis Ababa, Ethiopia: a retrospective cohort study. BMC Public Health. 2020 Oct 9;20(1):1532. doi: 10.1186/s12889-020-09645-x. PMID: 33036594; PMCID: PMC7547421.
3. Robert M, Kliegman, Joseph W. St Geme Iii, Nathan J. Blum, Md William H. Samir S. Shah, Robert C. Tasker, Mbbs, Karen M. Wilson Richard E. Behrman, Nelson *Textbook of Pediatrics, 22nd Edition 2022.*
4. Blumenkrantz MJ, Kopple JD, Gutman RA, et al. Methods for assessing nutritional status of patients with renal failure. Am J Clin Nutr 1980; 33:1567-85.
5. Nutrition Landscape Information System (NLiS) country profile indicators: interpretation guide, second edition. Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO
6. Ikizler TA, Burrowes JD, Byham-Gray LD, Campbell KL, Carrero JJ, Chan W, Fouque D, Friedman AN, Ghaddar S, Goldstein-Fuchs DJ, Kaysen GA, Kopple JD, Teta D, Yee-Moon Wang A, Cuppari L. KDOQI Clinical Practice Guideline for Nutrition in CKD: 2020 Update. Am J Kidney Dis. 2020 Sep;76(3 Suppl 1):S1-S107. doi: 10.1053/j.ajkd.2020.05.006. Erratum in: Am J Kidney Dis. 2021 Feb;77(2):308. doi: 10.1053/j.ajkd.2020.11.004. PMID: 32829751.
7. Nelms CL, Shaw V, Greenbaum LA, Anderson C, Desloovere A, Haffner D, Oosterveld MJS, Paglialonga F, Polderman N, Qizalbash L, Rees L, Renken-Terhaerdt J, Tuokkola J, Vande Walle J, Shroff R, Warady BA. Assessment of nutritional status in children with kidney diseases-clinical practice recommendations from the Pediatric Renal Nutrition Taskforce. Pediatr Nephrol. 2021 Apr;36(4):995-1010. doi: 10.1007/s00467-020-04852-5. Epub 2020 Dec 14. PMID: 33319327; PMCID: PMC7910229.
8. Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, Allon M, Asif A, Astor BC, Glickman MH, Graham J, Moist LM, Rajan DK, Roberts C, Vachharajani TJ, Valentini RP; National Kidney Foundation. KDOQI Clinical Practice Guideline for Vascular Access:

2019 Update. Am J Kidney Dis. 2020 Apr;75(4 Suppl 2):S1-S164. doi: 10.1053/j.ajkd.2019.12.001. Epub 2020 Mar 12. Erratum in: Am J Kidney Dis. 2021 Apr;77(4):551. PMID: 32778223.)

9. Oladele, Clement Oyedele1,; Unuigbe, Evelyn2; Chukwuonye, Innocent Ijezie3; Obi, Emmanuel Chukwuebuka3; Ohagwu, Kenneth Arinze4; Oladele, Gloria5; Ojogwu, Louis Ikechukwu2. Assessment of Nutritional Status in Patients with Chronic Kidney Disease in Nigeria. Saudi Journal of Kidney Diseases and Transplantation 32(2):p 445-454, Mar–Apr 2021. | DOI: 10.4103/1319-2442.335457
10. Apostolou A, Printza N, Karagiozoglou-Lampoudi T, Dotis J, Papachristou F. Nutrition assessment of children with advanced stages of chronic kidney disease-A single center study. Hippokratia. 2014 Jul-Sep;18(3):212-6. PMID: 25694753; PMCID: PMC4309139.
11. Zaki ME, Hassan MM, Bazaraa HM, Ahmed HF, Badr AMM. Nutritional Status in Children with Chronic Renal Failure on Hemodialysis. Maced J Med Sci. 2012 Oct 15; 5(3):296-301. http://dx.doi.org/10.3889/ MJMS.1957-5773.2012.0234
12. Asefa M, Abebe A, Balcha B, Baza D. The magnitude of undernutrition and associated factors among adult chronic kidney disease patients in selected hospitals of Addis Ababa, Ethiopia. PLoS One. 2021 Jul 8;16(7):e0251730. doi: 10.1371/journal.pone.0251730. PMID: 34237068; PMCID: PMC8266056.
13. Abd Allah Zahed, A., Taher El Mougi, M., Mohamed Abu Farag, I., Ahmed Shaheen, M. (2018). 'ASSESSMENT OF THE NUTRITIONAL STATUS OF CHILDREN WITH CHRONIC KIDNEY DISEASE', Al-Azhar Journal of Pediatrics, 21(2), pp. 2118-2137. doi: 10.21608/azjp.2018.77253
14. Suárez-González M, Ordoñez-Álvarez FÁ, Gil-Peña H, Carnicero-Ramos S, Hernández-Peláez L, García-Fernández S, Santos-Rodríguez F. Nutritional Assessment and Support in Children with Chronic Kidney Disease: The Benefits of Working with a Registered Dietitian. Nutrients. 2023 Jan 19;15(3):528. doi: 10.3390/nu15030528. PMID: 36771235; PMCID: PMC9919631.
15. Gupta, Aditi1; Mantan, Mukta1,; Sethi, Monika2. Nutritional Assessment in Children with Chronic Kidney Disease. Saudi Journal of Kidney Diseases and Transplantation 27(4): p 733-739, Jul–Aug 2016. | DOI: 10.4103/1319-2442.185235

16. Iyengar A, Raj JM, Vasudevan A. Protein Energy Wasting in Children with Chronic Kidney Disease and End-Stage Kidney Disease: An Observational Study. J Ren Nutr. 2021 May;31(3):270-277. doi: 10.1053/j.jrn.2020.08.002. Epub 2020 Sep 18. PMID: 32958374.
17. Central Statistical Agency, Ethiopia Mini Demographic and Health Survey 2019, 2019, CSA, Addis Ababa, Ethiopia
18. Tsega T, Tesfaye T, Dessie A, Teshome T (2022) Nutritional assessment and associated factors in children with congenital heart disease— Ethiopia. PLoS ONE 17(9): e0269518
19. Imani PD, Aujo J, Kiguli S, Srivaths P, Brewer ED. Chronic kidney disease impacts health-related quality of life of children in Uganda, East Africa. Pediatr Nephrol. 2021 Feb;36(2):323-331. doi: 10.1007/s00467-020-04705-1. Epub 2020 Jul 31. PMID: 32737578.
20. Sozeri B, Mir S, Kara OD, Dincel N. Growth impairment and nutritional status in children with chronic kidney disease. Iran J Pediatr. 2011 Sep;21(3):271-7. PMID: 23056801; PMCID: PMC3446188.
21. Graf L, Candelaria S, Doyle M, Kaskel F. Nutrition assessment and hormonal influences on body composition in children with chronic kidney disease. Adv Chronic Kidney Dis. 2007 Apr;14(2):215-23. doi: 10.1053/j.ackd.2007.01.015. PMID: 17395125.
22. Chao, C. T., Tang, C. H., Cheng, R. W. Y., Wang, M. Y. H., & Hung, K. Y. (2017). Protein-energy wasting significantly increases healthcare utilization and costs among patients with chronic kidney disease: a propensity-score matched cohort study. *Current Medical Research and Opinion, 33*(9), 1705–1713. https://doi.org/10.1080/03007995.2017.1354823
23. Jiang YP, Shen Y, Liu XR. [An assessment of nutritional status in children on maintenance hemodialysis due to stage 5 chronic kidney disease]. Zhongguo Dang Dai Er Ke Za Zhi. 2018 Mar;20(3):189-194. Chinese. doi: 10.7499/j.issn.1008-8830.2018.03.005. PMID: 29530117; PMCID: PMC7389792.
24. El-Gamasy MA, Eldeeb MM. Assessment of physical and psychosocial status of children with ESRD under regular hemodialysis, a single centre experience. Int J Pediatr Adolesc Med. 2017 Jun;4(2):81-86. doi: 10.1016/j.ijpam.2017.01.001. Epub 2017 Jul 28. PMID: 31528682; PMCID: PMC6738519.

25. Foster BJ, Leonard MB. Measuring nutritional status in children with chronic kidney disease. Am J Clin Nutr. 2004 Oct;80(4):801-14. doi: 10.1093/ajcn/80.4.801. PMID: 15447884.
26. Anupama SH, Abraham G, Alex M, Vijayan M, Subramanian KK, Fernando E, Nagarajan V, Nageshwara Rao PK. A multicenter study of malnutrition status in chronic kidney disease stages I-V-D from different socioeconomic groups. Saudi J Kidney Dis Transpl. 2020 May-Jun;31(3):614-623. doi: 10.4103/1319-2442.289448. Erratum in: Saudi J Kidney Dis Transpl. 2020 Sep-Oct;31(5):1162. doi: 10.4103/1319-2442.301193. PMID: 32655048.
27. Harmer M, Wootton S, Gilbert R, Anderson C. Association of nutritional status and health-related quality of life in children with chronic kidney disease. Qual Life Res. 2019 Jun;28(6):1565-1573. doi: 10.1007/s11136-019-02104-0. Epub 2019 Jan 12. PMID: 30637552; PMCID: PMC6522445.
28. İstanbul Üniversitesi, İstanbul Tıp Fakültesi, Çocuk Sağlığı ve Hastalıkları Anabilim Dalı, Nefroloji Bilim Dalı, İstanbul. Growth, development and nutritional status in children with chronic renal failure Turkish J Nephrol 2003; 12: 170-176
29. Haile, Y.T., Legisso, T.Z. Trends and determinants of child stunting in Ethiopia: a longitudinal analysis of sociodemographic factors and regional disparities. BMC Public Health 24, 3391 (2024). https://doi.org/10.1186/s12889-024-20962-3
30. Martin, S., Mutuku, F., Sessions, J. et al. Factors associated with early childhood stunted growth in a 2012–2015 birth cohort monitored in the rural Msambweni area of coastal Kenya: a cross-sectional study. BMC Pediatr 20, 208 (2020). https://doi.org/10.1186/s12887-020-02110-z
31. Iorember FM. Malnutrition in Chronic Kidney Disease. Front Pediatr. 2018 Jun 20;6:161. doi: 10.3389/fped.2018.00161. PMID: 29974043; PMCID: PMC6019478
32. WHO guideline on the prevention and management of wasting and nutritional oedema (acute malnutrition) in infants and children under 5 years: web annex E: filtered prognostic factors in infants and children with severe wasting and/or nutritional oedema. World Health Organization. https://iris.who.int/handle/10665/375143. License: CC BY-NC-SA 3.0 IGO

33. Karava V, Dotis J, Kondou A, Printza N. Malnutrition Patterns in Children with Chronic Kidney Disease. Life (Basel). 2023 Mar 6;13(3):713. doi: 10.3390/life13030713. PMID: 36983870; PMCID: PMC10053690.
34. Atalell, K.A., Techane, M.A., Terefe, B. et al. Mapping stunted children in Ethiopia using two decades of data between 2000 and 2019. A geospatial analysis through the Bayesian approach. J Health Popul Nutr 42, 113 (2023). https://doi.org/10.1186/s41043-023-00412-3
35. Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. 2021. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF.
36. Diao J, Chen L, Wei J, Shu J, Li Y, Li J, Zhang S, Wang T, Qin J. Prevalence of Malnutrition in Children with Congenital Heart Disease: A Systematic Review and Meta-Analysis. J Pediatr. 2022 Mar; 242:39-47. e4. doi: 10.1016/j.jpeds.2021.10.065. Epub 2021 Nov 3. PMID: 34742752.
37. KDOQI Work Group. KDOQI Clinical Practice Guideline for Nutrition in Children with CKD: 2008 update. Executive summary. Am J Kidney Dis. 2009 Mar;53(3 Suppl 2): S11-104. doi: 10.1053/j.ajkd.2008.11.017. PMID: 19231749.
38. Kumar J, McDermott K, Abraham AG, Friedman LA, Johnson VL, Kaskel FJ, Furth SL, Warady BA, Portale AA, Melamed ML. Prevalence and correlates of 25-hydroxyvitamin D deficiency in the chronic kidney disease in Children (CKiD) cohort. Pediatr Nephrol. 2016 Jan;31(1):121-9. doi: 10.1007/s00467-015-3190-7. Epub 2015 Aug 26. PMID: 26307635; PMCID: PMC4884450.
39. Kari JA, El Desoky SM, El-Morshedy SM, Habib HS. Vitamin D insufficiency and deficiency in children with chronic kidney disease. Ann Saudi Med. 2012 Sep-Oct;32(5):473-8. doi: 10.5144/0256-4947.2012.473. PMID: 22871615; PMCID: PMC6080997.
40. Yamane, T. (1967). Statistics: An Introductory Analysis, 2nd Ed. New York: Harper and Row.

Annexes

Annex I: Checklists

This Checklists was developed by the principal investigator after revising different

literatures on nutritional status and associated factors among children with CKD

(,9, 18, 19, 22, 23, 26).

Dear Sir/Madam

My name is Dr Adino Melkamu a final year Pediatric and Child health resident at Addis Ababa University, Tikur Anassa Specialized Hospital. I am conducting research entitled above. I kindly ask you participate in this study by answering the questions listed in the check list, letting me review your medical chart and laboratory results.

All the information you give is confidential and you have the right to not participate or withdraw from the study at any point. I am delighted to answer any of your questions.

To the respondent

Was read to me and clearly understood the purpose of the research, the procedures, issues of confidentiality, and withdraw from the study at any time. I hereby confirm the above statements with my signature (signature of interviewer certifying that respondent has given informed consent verbally).

Address: Dr Adino Melkamu

Phone number: +251941259122

Email: dradinomelkamu@gmail.com

Sociodemographic factors

1/ Age group

A, <1 years B, 1–3 years C, 3–5 years

D, 5–10 years E, >10 years

2/ Sex

A, Male B, Female

3/ Address by region

A, Addis Ababa B, Amhara C, Oromia

D, SNNS E, Afar F, Somali G, others

4/ Religion

A, Orthodox B, Muslim C, Protestant D, Catholic E Other

5/ School-eligible and in school

A, Yes B, No

6/ missed school days per month if enrolled in school----------

7/ Primary caregiver,

A, Parent B, Other

8/ Caregiver's education level,

A, Primary B, Secondary C, Tertiary D, Graduate E, None

9, Occupation

A, Farmer B, Government employee C, Daily laborer D, Merchant

E, Private employee

10, Monthly income

A, <5000ETB B, 5000-7000ETB

C, 7000-10000ETB D, >10000 ETB

11/ Cost per clinic visit,

A, <1000ETB B, 1000-2000ETB C, >2000ETB

Disease conditions and associated factors

12, Anthropometric indices

A, Age D, MUAC

B, Weight E, HC

C, Height /length

13, Anthropometric interpretation

A, HFA/LFA B, MUAC C, HC D, WFL/H E, BMI/FA

14, Presence of weight loss (kg) over the last 3months

A, Yes B, No

15, Clinical symptoms (can be more than 1)

A, Nausea B, Vomiting C, Poor appetite D, body swelling

16, Duration of illness after diagnosis of CKD

A, less than one year B, 1-3years C, 3-6years D, more than 6 years

17, Causes of CKD

A, (PUV) Posterior Urethral Valve E, Nephrotic syndrome

B, Neurogenic bladder F, SLE

C, Glomerulonephritis G, Metabolic causes

D, Other Congenital Urinary Tract Disorder H, other….

18, Stages of CKD (GFR)

A, Stage 1 B, Stage2 C, Stage3 D, Stage4 E Stage 5

19, Laboratory indices (recent values)

A, Hemoglobin/hematocrit----- D, Serum vitamin D level -----

B, Serum albumin--------- E, Urea/BUN level--------

C, Serum creatinine ------ F, Serum Phosphorus level……

20, **History of dialysis**

A, Yes B, No

21, **Presence of comorbidity**

A, Yes B, No

----------End----------