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Diet and Comorbidities Affecting Hemodialysis Patients at the Renal Unit in Kenyatta National Hospital, Kenya: A Cross Sectional Analytic Study

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ABSTRACT

Though there are good guidelines by the Kidney Disease Outcome Quality Initiative on the recommended dietary energy and protein intake, haemodialysis patients are unable to meet because of dietary restrictions to prevent sodium, potassium and phosphorus mineral imbalances, low socioeconomic status and presence of comorbidities. In Kenya 4% are affected by renal failure which may not be the true burden as the country lacks national renal registries. There is inadequate information on the actual dietary intake and comorbidities affecting the haemodialysis patients in Kenya which this study sought to answer. A cross-sectional analytic study was conducted among 84 respondents undergoing haemodialysis present during the month of November 2021 at Kenyatta National Hospital renal unit. They were selected using consecutive purposive sampling. Data collection was done using a researcher administered digitalized questionnaire for the socio-demographic and economic factors, selected comorbidities that affect dietary intake, two 24hr dietary recalls both on non-dialysis and dialysis days, a 7-day food frequency questionnaire and nutrition supplement consumption. Statistical Package for Social Sciences (SPSS) Version 25 was used to analyse data. The mean age was 42.24±16.6 years with 41 males and 43 females. Employed were 38.1% and 66.7% relied on family for financial support. Fluid overload (50%), Diabetes Mellitus (20.2%), severe gastrointestinal disturbances (10.8%), present or past malignancy (4.8%) and cardiovascular illness (4.8%) were the comorbidities present among the respondents. The average energy intake was 14.738±8.46 kcals/ kg body weight/ day with non-dialysis energy intake being statically significantly higher (p=.017) than on dialysis day. The mean protein intake was 0.43g/kg/day. The mean daily micronutrient intake was as follows: sodium, 904.54±805.27mg; potassium 973.57±595.2mg; phosphorus, 549.835±401.91mg; calcium, 203.78±127.325mg; zinc 4.92±4.02mg; vitamin C, 42.83±31.58mg; and vitamin B6, 0.815±0.685mg. This study reveals that there is low dietary macro and micronutrient intake among haemodialysis patients particularly intradialytic days.

Keywords: Haemodialysis patient; dietary energy intake; dietary protein intake; micronutrient intake; comorbidities

INTRODUCTION

Chronic Kidney Disease is a public health concern as stated by the Global Burden of Disease 2015 since it has risen from being the 25th in 1990 to being the 17th leading cause of death globally in 2015 (1). About 19 million disability-adjusted life years which was 19.6% increment from 2005 to 2015 was directly attributable to the reduced Glomerular Filtration Rate (2).

The prevalence of Chronic Kidney Disease in Kenya is 4% which may not be the true

picture as there are no national renal registries (3). The major aetiologies of renal failure that is hypertension and diabetes are epidemic in Kenya. According to the Kenya STEPs survey 2015 the prevalence of diabetes in Kenya is at 4.6% which is approximately 750 000 people while hypertension ranges from 18%- 21.4% (4).

It is reported that over 5% of newly diagnosed type II diabetes already have CKD and projected 40% of both type I and II diabetes develop CKD in their lifetime mostly the first 10 years after diagnosis (5). Diabetes mellitus was indicated to be among the three major aetiologies of chronic kidney disease in 25 out of 30 countries in Sub Saharan Africa apart from chronic glomerulonephritis and hypertension. Diabetes was the major cause in 9%-15% of End Stage Renal Disease (ESRD) patients in Kenya (6).

There are multiple dietary restrictions imposed on the haemodialysis patients to prevent mineral imbalances such as sodium, potassium and phosphorus which lead to nutritionally inadequate diet (7). Dietary sodium intake is linked to other nutrients thus restricting sodium affects patients overall dietary protein and energy intake. Potassium rich foods are normally heart friendly foods such as fresh fruits and vegetables, legumes and grains thus restricting them cause the burden of cardiovascular diseases in CKD patients (8).

Nutrient intake is further worsened by the comorbidities such as Diabetes where diabetic dialysis patients are restricted on dietary carbohydrates that may not be beneficial due to risk of hypoglycaemia and whole grain cereals having high levels of potassium (9). It is also noted that haemodialysis patients suffer from gastrointestinal disturbances such as nausea and vomiting, impaired protein absorption and bacteria overgrowth in the gut, diabetic gastroparesis, pancreatic insufficiency, ascites which reduce optimal nutrient intake. Polypharmacy also worsen gastrointestinal disturbance (10,11).

Various African research studies reported that low socioeconomic status of haemodialysis patients because of unemployment and lack of health insurance caused low adherence to the renal prescribed diet. The patients and their caregivers also reported that some of the recommended diets were costly to afford for a long-time basis hence consumed the cheap restricted diets (3,12).

The recommended daily energy intake for haemodialysis patients is 35Kcal/Kg ideal body weight/ day for individuals who are below 60 years and 30-35 Kcal/Kg ideal body weight/day for individuals who are 60 years and above. KDOQI guidelines recommend DPI for clinically stable haemodialysis Patients to be 1.2g/kg ideal body weight/day with 50% of the protein being high biological value (13).

Various research studies report that most haemodialysis patients fail to reach the minimal protein recommendations, with average protein intake being 0.9-1.1g/kg/day because of dietary restrictions of phosphorus that is normally high in high biological value protein foods (14,15). High proportion of patients consume excess fat with saturated fat contributing the highest percentage, this is because the dietary restrictions exclude fat as the major source of energy and because of unhealthy eating habits (15).

Current guidelines propose intake of 1500-3000 mg/day mostly 2.4g of sodium per day which is equivalent to 1 level teaspoon of salt per day (16). Recommended dietary potassium intake levels ranges from 1950-2730mg/day for haemodialysis patients (15). The advocated dietary phosphorus intake for haemodialysis patients is 800-1000mg/day (17–19). Deficiency of folate and Zinc causes low appetite, nausea, vomiting and diarrhoea in haemodialysis patients. Zinc enhance taste acuity, increases appetite and caloric intake thus advocated to be taken 15mg daily (20).

Vitamin C is essential to lessen the chances of cardiovascular disease, fatigue and chronic inflammation (18). Recommended

Vitamin C intake is 60-100 mg/day but its low in haemodialysis patients due to taking of low amount of fruits and vegetables and also boiling vegetables before cooking to prevent hyperkalaemia (20). Folate and vitamin B6 are water soluble vitamins of low molecular weight hence there is greater loss in dialysis. Recommended intake of folate is 1-5mg/day, vitamin B6 2-10mg/day and vitamin B12 3ug/day for haemodialysis patients (21).

This study aimed at identifying the:

Socioeconomic and demographic status of haemodialysis patients at renal unit in Kenyatta National Hospital (KNH).

The prevalence of selected comorbidities that affect dietary intake in the respondents and

The dietary macro and micronutrient intake of haemodialysis patients

MATERIALS & METHODS

The study employed cross sectional analytical research method design. The research targeted haemodialysis patients ages 13 years and above who were dialyzing 1-3 times per week for three months in Kenyatta National Hospital. Fisher formula for finite population was utilised to determine the sample size. Consecutive purposive sampling was used on each day to recruit the participants in November 2021 until the expected sample size of 84 patients was attained. Data collection was done using a researcher administered digitalized questionnaire for the socio-demographic and economic factors, selected comorbidities, two 24hr dietary recalls both on non-dialysis and dialysis days, a 7-day food frequency questionnaire and nutrition supplement consumption.

STATISTICAL ANALYSIS

Data analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 25. Average of dietary intake was calculated using Nutri-survey database. Intake of key nutrients of interest among haemodialysis patients were compared to the current recommended nutrient intake (RNIs) guidelines. Data on age, marital status, income/financial support and education was expressed as frequencies and percentage. Continuous variables used measures of central tendency such as mean ±SD or medians (lower and upper quartiles). Significance level was set at 95% confidence interval ($P<0.05$). Pearson Correlation Coefficient (r) was used to assess significant relationship.

RESULT

Demographic Characteristics of Participants

The study involved 84 participants with a mean age of 42.24±16.65 years with the youngest participant being 13 years and the eldest 78 years old. The gender of the participants was almost even with 51.2% being female and 48.8% male. More than half of the respondents 53.6% were married, 32.1% single, 9.5% widowed and 4.8% were either separated or divorced. More than half 51.2% of the hemodialysis patients had dialyzed for a period of less than a year, 40.5% between 1-4 years while only 8.3% had dialyzed for more than 4 years. Majority of the patients 95.2% had two dialysis sessions per week while few were dialyzing once 3.6% or thrice 1.4% per week.

Table 1: Demographic factors of the hemodialysis patients at KNH renal unit

	(%)
Age Group (Years)	
<16	3.6
16-25	14.3
26-35	21.4
36-45	17.9
46-55	17.9
56-65	15.5
>65	9.5
Total	100
Mean Age (SD)	**42.24± 16.65**
Gender	
Male	48.8
Female	51.2
Marital Status	
Single	32.1
Married	53.6
Separated/ divorced	4.8
Widowed	9.5
Dialysis Period	
< 1 year	51.2
1-4 years	40.5
>4 years	8.3
Dialysis sessions per week	
Once per week	3.6
Twice per week	95.2
Thrice or more per week	1.4

Socio-economic Characteristics of participant

Majority (42.9%) had completed secondary school education while those who attained primary and tertiary level accounted for 28.6% and 27.4% respectively.

A greater number (61.9%) of the hemodialysis patients reported to have no form of employment while 38.1% were employed. Most of the patients 66.7% derived their financial support from family members, 28.6% were able to support themselves while 2.4% received financial food intake and nutrition status. support either from friends or well-wishers. In addition to that, 61.9% reported that the financial provision they got was regular and able to support them adequately while 38.1% said it was irregular and inadequate.

A notable high proportion of the respondents (88.1%) were NHIF registered and it was active. Although, the nutrition services charges were not catered for the NHIF cover causing most of them not to seek the nutritionist regularly for adequate professional counselling and review of their food intake and nutrition status.

Table 2: Socioeconomic characteristics of hemodialysis patients at KNH renal unit

Socio-economic characteristics	(n)	(%)
Education		
Primary level	24	28.6
Secondary level	37	42.9
Tertiary level	23	27.4
Employed		
Yes	32	38.1
No	52	61.9
Major source of financial support		
Self	24	28.6
Family Members	56	66.7
Friends	2	2.4
Well-wishers	2	2.4
Adequacy of financial support or income		
Regularly and cater for my expenses well	52	61.9
Irregular and unable to support me adequately	32	38.1
NHIF registered		
Yes	74	88.1
No	10	11.9

Prevalence of selected comorbidities affecting dietary intake

The results showed that 20.2% of the renal patients had been diagnosed with Diabetes Mellitus prior to kidney failure which persisted during dialysis with some experiencing hypoglycemia after dialysis. Half of the dialysis respondents 50% had fluid overload of which 52.4 % of them had bilateral edema to the ankles, 38.1% to the knees and 9.4% had general edema or ascites.

Gastrointestinal disturbances such as anorexia, nausea, vomiting, diarrhea and constipation that affected food intake and consumption were also noted among dialysis patients. Forty four percent (44%) of the dialysis respondents reported to have experienced some of the gastrointestinal disturbances prior the study. The gastrointestinal disturbances were severe among 10.8% of the patients who stated to have had diarrhea, frequent vomiting and severe anorexia that lasted for more than two weeks prior the study.

Some of the dialysis patients 4.8% had experienced metastatic malignancy with one of them reported to have had esophageal cancer which severely caused dysphagia and had to be on full liquid diet. The others reported that the cancer treatment triggered renal failure. Cardiovascular illnesses affected 4.8% of the hemodialysis patients.

Table 3: Presence of comorbidities in hemodialysis patients at KNH renal unit

Comorbidities	(n)	%
Diabetes mellitus	17	20.2
Fluid overload	42	50
• Bilateral edema to the ankles +	22	52.4
• Bilateral edema to the knees++	16	38.1
• General edema or ascites+++	4	9.5
Gastrointestinal disturbances (anorexia, nausea, vomiting, diarrhea, constipation)	37	44
• Mildly decreased appetite or mild nausea for <2 weeks	20	54.1
• Occasional vomiting and abdominal pains for the last 2 weeks	13	35.1
• Diarrhea, frequent vomiting or severe anorexia for > 2 weeks	4	10.8
Metastatic malignancy or current/past recent chemotherapy	4	4.8
Cardiovascular illness	4	4.8

Dietary Macro and Micro Nutrient of Hemodialysis Patients

The study findings indicated that the average energy intake of the hemodialysis respondents on non-dialysis day was 912.4± 518.92SD kcals while day on dialysis was 834.1±607.72SD kcals. Their average dietary energy intake was 14.73±8.46Kcal/kg/day. The average protein intake of the renal patients was 0.43g/kg/day which is way below the recommended protein intake of 1.2g/kg bodyweight per day, only 3 patients out 84 were able to meet the dietary protein requirement. Average sodium intake was 904.54mg which was within the proposed guidelines of 500-2000mg/day. Potassium intake was 973.57mg, below potassium intake limit of within 2-5g/day. Dietary phosphorus intake was 549.84mg which was lower than the dietary guidelines of 800-1000mg/day. Calcium dietary intake was 203.78mg/ day. Dietary fiber intake was 15.49g/day lesser than 20-25g/day which is not healthy as fiber lower risk of cardiovascular illnesses. Zinc intake was 4.92mg/day much lower than 15mg/day the Recommended Dietary Intake (RDI). Vitamin C was 42.83mg/day lesser compared to 60-100mg/day RDI.

Table 4: Macro and micronutrient intake of hemodialysis patients at KNH renal unit in reference to RNI

Nutrient	Recommendation for hemodialysis patients	Nutrient Intakes of the Subjects (Mean ± SD)	Percentage % of patients that met RDIs
Energy Calorie Kcal/Kg BW/day	<60 years old: 35 ≥ 60 years old: 30-35	14.738± 8.46	4.7
Protein g/kg BW/ day	1.2	0.427 ± 0.23	3.5
Water (g)	500-1000ml	377.97 ± 181.05	50.0
Fat (g)		30.235±27.38	11.9
Carbohydrates (g)		122.53±91.415	14.3
Dietary Fiber (g)	20-35g/day	15.485±12.495	4.7
PUFA (g)		13.235±13.465	-
Vitamin A (µg)	700-900	490.035±446.765	0
Vitamin B1 (mg)	1.1-1.2	0.63±0.54	1.1
Vitamin B2 (mg)	1.1-1.3	0.53±0.36	0
Vitamin B6 (mg)	1.3-1.7	0.815±0.685	3.5
Total Folic Acid (µg)	800-1000	96.37±50.37	0
Vitamin C (mg)	60-100	42.83±31.58	1.1
Sodium (mg)	500-2000	904.54±805.27	100
Potassium (mg)	2000-3500	973.57±595.2	9.5
Calcium (mg)	Men: 700 Women: 700-800	203.78±127.325	21.4
Magnesium (mg)		211.67±177.215	-
Phosphorus (mg)	800-1000	549.835±401.91	8.3
Zinc (mg)	8-11	4.92±4.02	13.1
Iron (mg)	Men: 10 20-49 years women: 14 ≥ 50 years women: 9	5.94±6.13	6.0

Using Pearson Product correlation, the energy kilocalories intake for dialysis and non-dialysis day was found to be statistically significantly different (r = .260, P = .05) implying that the patients had lower dietary and energy intake on the day

on dialysis than on non-dialysis day using 24hr dietary recall.

Table 5: Difference between energy intake in dialysis and non-dialysis days in hemodialysis patients

Significant difference relationship	(r)	P-value
Energy Kcal on dialysis day and non-dialysis day	.026*	.017

Nutrition Supplementation

Most of the nutrition supplements taken by the hemodialysis patients were Calcium salts which contain calcium, magnesium, zinc and Vitamin D3 and can be used interchangeably as phosphate binders. Other nutrition supplements were used to treat vitamin deficiency and reduce neuropathic pain.

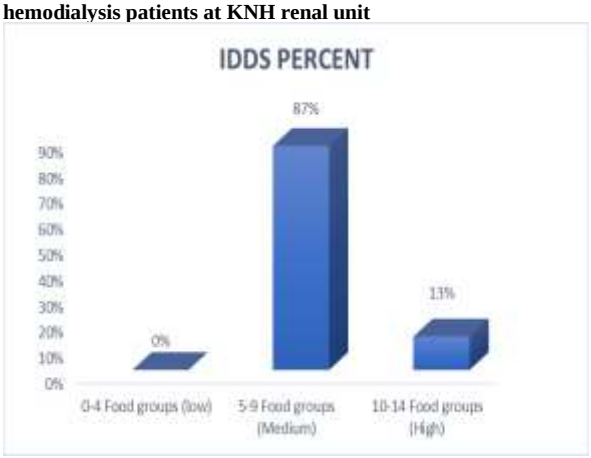
Table 6: Nutrient supplements taken by hemodialysis patients at KNH renal unit

Nutrition Supplement	Brand Name	Use of Supplement	No. of patients
Calcium Citrate with Magnesium, Vitamin D3 and Zinc	Zedcal, Bonium, Osteocare, Solaray, M-cal,	Treat hypocalcemia, Hypo-magnesia and hyperphosphatemia	13
Vitamin B1+B6+B12	Tribees Forte	Contains thiamine essential coenzyme for carbohydrate metabolism. Pyridoxine principally used for amino acid metabolism. Cyanocobalamin acts as coenzymes in nucleic acid synthesis and is involved with folic acid too. Used to treat neuropathic pain	1
Iron and Vitamin Supplement	Viviron Syrup	Treat vitamin deficiency for teenagers	1
Caloric, protein vitamin and minerals composite	Ensure	Gives calories, protein, vitamins and minerals for healthy weight gain. Used for protein-energy malnutrition	1
TOTAL			**16**

Individual Dietary Diversity Score

The average Individual dietary diversity score using the 24h recall was 8.36±0.95, with minimum score being 6 and the maximum score 10. Only 13% had a high dietary diversity score but the rest 87% had a medium IDDS.

Figure 1: Individual Dietary Diversity Score of the hemodialysis patients at KNH renal unit



7-Day Food Frequency Questionnaire

To assess the different foods consumption and dietary diversity a 7-day food frequency questionnaire was used. The respondents were requested to state the frequency of the food consumed in the previous week prior to the data collection. Several food items with nutrients of importance to renal patients were reported.

Some of the hemodialysis patients consumed potassium rich foods such as irish potatoes (1.2%) and avocadoes (2.4%) indicating that not all patients followed the required recommendation of avoiding high potassium foods. Vegetables such as kales were consumed by 20.2% of the hemodialysis patients, spinach 15.5%, cow peas leaves by 13.1%, pumpkin leaves 7.1% and other African leafy vegetables like African night shade (managu) and saget by 28.6%. Though these vegetables were first dipped in hot water or boiling water for 5 minutes, water discarded then recooked to lower both potassium and sodium content. The most common vegetable consumed by the renal patients was cabbage whereby 45.2% took 2-3times per week, 10.7% 4-6 times per week and 29.8% on a daily basis as cruciferous vegetables are low in potassium. Low potassium fruits such as apples, watermelon, pineapples, pawpaw and tangerines which are also rich in antioxidants, thiamine and vitamin C were commonly consumed 2-3 times per week.

Nuts and seeds are high in potassium thus majority of the hemodialysis patients did not take groundnuts (82%).

Hemodialysis patients are recommended to take 50% of their protein intake from high biological value animal protein. In this study more than half 53.6% consumed beef/ goat or mutton, 22.6% took eggs and 10.7% poultry in 2-3days a week. Only 6% of the patients consumed beef/goat/ mutton and 2.4% consumed eggs on a daily basis. Tea with whole milk 89.3% was the most common beverage drank by the hemodialysis patients on a daily basis at limited amounts of 200ml during breakfast, 10 o'clock and 4 o'clock on dialysis days offered as part of hospital meals. Fish and Omena had low consumption among the hemodialysis patients as only 9.5% took fish and 6% consumed Omena 2-3times per week. Legumes were mostly consumed 2-3 days in a week (dry kidney beans 38.1% and green grams 33.3%) which was most served at the renal unit for lunch showing that most patients took only when they came for dialysis. High energy consumption is recommended for the patients. Bread was the most consumed starch as 64.3% consumed it on a daily basis especially during breakfast. A majority 70.2% used sugar to sweeten their beverages. Ugali (stiffened porridge) was second most consumed energy giving food as 36.9% consumed it 4-6times per week. White rice was consumed during dialysis days at the hospital by most of the renal patients (46.4%) as they took it 2-3 times in a week.

Table 7: 7-day Food Frequency Questionnaire of selected foods taken by hemodialysis patients

Food Type	O (Never)		2-3 Days		4-6 Days		Daily	
	N	%	N	%	N	%	N	%
Irish potatoes	83	98.8	0	0	0	0	1	1.2
Bread	4	4.8	19	22.6	7	8.3	54	64.3
White rice	5	6	39	46.4	21	25	19	22.6
Ugali	9	10.7	25	29.8	31	36.9	19	22.6
Carrots	24	28.6	30	35.7	16	19	14	16.7
Kale	66	78.6	17	20.2	1	1.2	0	0
Spinach	69	82.1	13	15.5	1	1.2	1	1.2
Kunde (cowpeas)	69	82.1	11	13.1	3	3.6	1	1.2
Pumpkin leaves	75	89.3	6	7.1	3	3.6	0	0
African vegetables	38	45.2	24	28.6	14	16.7	8	9.5
Cabbage	12	14.3	38	45.2	9	10.7	25	29.8
Tomatoes	1	1.2	0	0	0	0	83	98.8
Pawpaw	57	67.9	18	21.4	7	8.3	2	2.4
Mangoes	82	97.6	2	2.4	0	0	0	0
Watermelon	43	51.2	32	38.1	8	9.5	1	1.2
Apples	44	52.4	23	27.4	8	9.5	9	10.7
Pineapples	63	75	13	15.5	7	8.3	1	1.2
Avocado	82	97.6	2	2.4	0	0	0	0
Oranges	79	94	2	2.4	3	3.6	0	0
Tangerines	80	95.2	2	2.4	2	2.4	0	0
Liver	83	98.8	1	1.2	0	0	0	0
Beef/goat/mutton	18	21.4	45	53.6	16	19	5	6
Chicken	74	88.1	9	10.7	1	1.2	0	0
Eggs	59	70.2	19	22.6	4	4.8	2	2.4
Fish	73	86.9	8	9.5	2	2.4	1	1.2
Omena	78	92.9	5	6	1	1.2	0	0
Dry kidney beans	37	44	32	38.1	15	17.9	0	0
Black beans	80	95.2	4	4.8	0	0	0	0
Lentils	77	91.7	6	7.1	1	1.2	0	0
Green grams	49	58.3	28	33.3	5	6	2	2.4
Peas	72	85.7	7	8.3	4	4.8	1	1.2
Groundnuts	82	97.6	1	1.2	1	1.2	1	1.2
Whole milk	3	3.6	3	3.6	3	3.6	75	89.3
Fermented milk	79	94	4	4.8	1	1.2	0	0
Yoghurt	80	95.2	1	1.2	3	3.6	0	0
Tea	3	3.6	1	1.2	1	1.2	79	94
Sugar	19	22.6	2	2.4	4	4.8	59	70.2

Relationship Between Demographic and Socio-economic Characteristics and the dietary intake

Pearson Product Coefficient correlation revealed that there was non-significant relationship between demographic and socio-economic characteristics (age, gender, education, employment, financial support and social support) and the average dietary energy intake per kilogram per day.

Table 8: Relationship between demographic and socio-economic status and the average energy intake per kg per day

Relationships	(r)	P-value
Age and average dietary energy intake/kg/day	-.171	.120
Gender and average dietary energy intake/kg/day	.059	.593
Education and average dietary energy intake/kg/day	.012	.917
Employment and average dietary energy intake/kg/day	.039	.722
Financial support and average dietary energy intake/kg/day	-.013	.910
Social support and average dietary energy intake/kg/day	.126	.252

Relationship between diabetes mellitus and dietary intake

The study noted a negative non-significant relationship between diabetes mellitus and energy intake per kg body weight per day.

Table 9: Relationship between diabetes mellitus and average energy intake per kg per day.

Significant Relationship	(*r*)	(P-value)
Presence of diabetes and Energy intake/kg/day	-.177	.108

DISCUSSION

The average age of the haemodialysis patients in this research was 42.24 (±16.655) years which was comparable to Matiko et al., (2016) study which was conducted on the same study site KNH renal unit where the average age was 44.2 (±15.8) years and also in Ghana 43.86 ± 17.84 years (22). These varies from other studies conducted in other African countries where the mean age was 51.19 years in Egypt (23) and 52.2 ±13.3 years in Tanzania (24). This shows in Kenya and some of African countries renal failure is affecting the productive age which can lower the economic status of the country if any measures are not put in place to curb or arrest chronic kidney diseases at early stages and advocate healthy lifestyle.

There are various factors that affect employment in haemodialysis patients which are hospital visits like three times per week, vascular dialysis access which causes them not to do manual jobs, physical distress and fatigue (25). This however not only affect the purchasing power of the patients but it has also been associated with poor nutrition status. Most of the patients opt for self-employment as an alternative form of self-support which was seen in this study whereby most of the 28.6% participants who reported to be self-support had small businesses.

Current study found that 20.2% of haemodialysis patients had diabetes mellitus as an aetiology which persisted even after dialysis. This can also be seen in countries such as Taiwan 47%, Egypt 18.4%, Italy 12.2%, Libya 14% and Palestine 48.1% (21,23,26–28). Study that assessed variables associated with reduced dietary intake in haemodialysis patients in Italy found that all patients who had end stage renal disease secondary to diabetes consumed lower than the recommended dietary protein intake of 1.2g/kg/day and energy intake of 30kcals/kg/day (26). Though there is a negative non-significant relationship between diabetes mellitus and energy intake per kg body weight per day in this study this research second the result conducted Italy.

Haemodialysis patients are expected to consume high energy and protein diet putting into consideration sodium, potassium, calcium, phosphorus and fluids restriction. Though this seems a good advice, most haemodialysis patients struggle observing the dietary therapy because of the over restricted diet, stress and low appetite (29). The haemodialysis patients in this study ingested only 14.73±8.46Kcals/kg/day on average which was lower than the recommended energy intake according to KDOQI (Kidney Disease Outcome Quality Initiative) guidelines of 30-35kcal/kg/day and had a mean protein intake of

0.43g/kg/day which was significantly lower than advocated 1.2g/kg/day. The patients obtained 56% of the energy from carbohydrates and 31% from total fat which was within the recommended that is 25-35% only of the energy intake should come from lipids (30).

These results depict low macronutrient intake of haemodialysis patients which is consistent with other published findings. Study carried out in Korea that assessed 7 pre-dialysis days using 24hour dietary recall dietary intake found out the energy intake to be 23.44kcal/kg/day and protein consumption of 0.92g/kg/day. In this research, respondents obtained most energy from carbohydrates (about 60%) and approximately 23% from lipids (29). Study conducted in Korea using the 3-day diet history (dialysis, non-dialysis day and weekend) which was verified by a dietician found the dietary energy intake to be 21.9± 6.7 kcal/kg body weight/day and dietary protein intake been 0.9±0.3g/kg/day (31). Assessment of dietary intake using 3 day diet diaries in Italy found the average dietary energy and protein ingestions were 24.9±10.1kcal/kg/day and 0.64±0.4g/kg/day respectively (32). Research conducted in India where they utilized 24hr-recall three times within duration of 30 days (month) in between found that the average energy and protein intake was 1580.5kcals and 54g respectively where the average patients' weight was 57.38kg which means they consumed 27kcals/kg BW/day of energy and 0.94g/kg BW/day protein. The patients obtained 51.7% from carbohydrates and 27.9% from lipids (30). The inadequate total food intake and quality is because renal diets are monotonous and lacks dietary diversity making it difficult to meet the recommended nutrients (33).

The energy consumption on the non-dialysis day was 912.4± 518.92SD Kcals statistically significantly higher (r = .260, P = .05) than the dialysis day 834.1±607.72SD Kcals. These findings agree with those conducted in United States using 3-day food record where the average food intake on weekday dialysis day was 1387.7gms compared to 1614.4gms on weekday not on dialysis and 1560.4gms on weekends not on dialysis. The food volume, energy and protein intake are usually the lowest during dialysis treatment days because of the disrupted meals schedules (18).

The patients from this study drank 377.97 ml/day of fluids on average. Sodium, potassium, calcium and phosphorus intake were 904.54, 973.57, 203.78 and 549.835mg/day respectively which means that their fluids, sodium, potassium, calcium and phosphorus was notably lower KDOQI limits. These findings coincide with a survey conducted in Korea which found that dietary calcium intake was 349.33mg potassium 1856.91mg and phosphorus 760.61mg (29). This was lower than KDQOI guidelines which advocates phosphorus potassium and calcium intake to be 800-1000mg, 1950-2350mg and 700-800mg respectively. Nevertheless, the sodium intake (3285.86mg) of the Korean patients was higher than the endorsed intake of <1500mg. Study conducted in Israel noted that the calcium intake was lesser 635.4 ± 563.8 while the phosphorus 1169 ± 407.6mg, potassium 2233 ± 717.6mg and sodium 2825.5 ±1012 intake of dialysis patient were more than the endorsed standards (34).

CONCLUSION

From the current study findings, it is notable that the affected age by renal failure was the productive age. Majority of the haemodialysis patients were married and the gender was evenly distributed. Most of them dialyzed twice per week.

Secondary education was the highest attained by majority of the haemodialysis patients. A greater number reported to have no form of employment and thus financial support was necessary. Family support was the predominant financial support while others opted for self-employment because of frequent hospital visits for dialysis session and acquisition of dialysis items for the next

dialysis sessions. Fortunately, more than half of the patients reported that the support was regular and able to support them adequately. A greater part of the respondents was NHIF registered but the nutrition services were not covered in the insurance causing them not to frequently seek the nutritionist for review and counselling.

Fluid overload a comorbidity present in haemodialysis patients was seen in half of the respondents. Diabetes mellitus was noted in a fifth of the participants. A substantial number of patients suffered from gastrointestinal disturbance with few having severe gut problems that is nausea, vomiting and diarrhoea that persisted for more than two weeks prior to the study. Cardiovascular illness and malignancy were seen at a low percentage.

The energy and protein intake were inadequate compared to the KDOQI guidelines with a lower percentage attaining the expected dietary intake which can result to protein energy wasting. Energy intake during dialysis days was significantly lower than non-dialysis days because of the interruption in meal schedules. Fluid, sodium, potassium and calcium intake was lower than the KDOQI limits. This shows that most of them followed the dietary restrictions nutrition directives to avoid fluid overload and mineral imbalances that would cause acute myocardial infarction and osteodystrophy. Most of the nutrition supplements taken by the haemodialysis patients were Calcium salts which contain calcium, magnesium, zinc and Vitamin D3 and can be used interchangeably as phosphate binders. Other nutrition supplements were used to treat vitamin deficiency and reduce neuropathic pain. The study found that the demographic and socio-economic characteristics were not significantly related to the average energy intake per kilogram per day. It was noted a negative non-significant relationship between presence of diabetes mellitus and energy intake per kilogram per day of the haemodialysis patients.

Declaration by Authors

Ethical Approval: Approved by Kenyatta University Ethical Review Committee approval number PKU/2217/11361 and Kenyatta National Hospital and University of Nairobi Ethics and Research Committee (KNH-UON ERC) approval number being P133/03/2021. Research Permit was obtained from National Council of Science, Technology and Innovation (NACOSTI) Reference number NACOSTI/P/21/8370. The participatory was voluntary and they gave verbal consent before interviewing.

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