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Nutritional status of patients according to the stage of chronic renal failure

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ABSTRACT

Introduction. In Burkina Faso, chronic kidney disease (CKD) is a major public health problem due to its increasing prevalence, severity and the high cost of treatment. Aim. The aim of this study was to describe nutritional status of subjects diagnosed with severe and moderate stages of chronic renal insufficiency, followed in nephrology consultation at the Yalgado Ouedraogo University Hospital Center (YO-UHC) of Ouagadougou. Methods. A descriptive cross-sectional study conducted over a period of eight months and included 75 patients in total. The social-demographic parameters were determined on the basis of the patients' declaration and the use of their medical records. Biological parameters were collected from the results of laboratory examinations performed by each patient. The nutritional status of the patients was assessed by the anthropometric method. Finally, all patients were asked about their dietary habits and lifestyle using the 24-hour recall method. Results. Our results revealed a male predominance, out of the total number of patients included. The percentage of men and women was 54.70% and 45.30% respectively with a sex (male/female) ratio of 1.20. The average of Body Mass Index was 24.79 Kg/m^2. The percentage of overweight and obesity of women was 64.71% compared to 26.83% for men. The proportion of women with severe chronic kidney disease (58.82%) was twice as high as that of men (29.27%), (P<0.05). The average waist circumference of the subjects aged 30-39 years was significantly lower than that of the subjects aged 60-85 years. So, average hip circumference was 93.77 cm, with a significant difference according to sex (P<0.05). The prevalence of hyperglycaemia and diabetes increased with age. Hyperglycaemia in the 40-49 age group was increased significantly from 16.67% to 26.67% in the 70-85 age group (P<0.05). Diabetes in the 50-59 age group was 10% and doubled in the 70-85 age group (P<0.05). A percentage of 67.99% of the patients had a history of hypertension in either first-degree relatives or collaterals. The highest proportion was found in the hypertensive collaterals (37.33%; P=0.059). This study revealed a low level of physical activity among all patients. Only 38.67% of the patients practiced regular physical activity. There was no significant association between the level of physical activity and the stage of renal failure. Conclusion. Knowledge of nutritional status is a crucial part of better nutritional management of CKD patients. Finally, previous studies on the dietary habits of patients suffering from CKD will allow a better understanding of their nutritional status for a better management according to the stage of progression of the disease.

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Nutritional status, Chronic kidney disease, Stage of Chronic renal failure, Patient, Burkina Faso

INTRODUCTION

Chronic kidney disease (CKD) is now a global public health problem due to its increasing prevalence, severity and the high cost of treatment [1]. In 2019, more than one in ten adults had kidney disease, nearly 850 million worldwide [2]. It should be noted that the prevalence is around 1400 per million inhabitants in Japan and 500 per million inhabitants in France. In Africa, the prevalence of CKD is not well documented. However, in some countries such as Morocco, it was 257 cases per million inhabitants in 2010 [4; 5]. In Burkina Faso, the prevalence of the disease is also not well documented [6]. Nevertheless, it is estimated that the hospital prevalence was 27.1% at the time of the first nephrological consultation in 2011 [6].

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The adoption of glomerular filtration rate (GFR) thresholds suggests the classification of this disease into five stages of increasing severity [7]. When renal function deteriorates, nutrition plays an important role in the management of the disease, starting in the early stages. Adapting the diet will help maintain a stable metabolic state, and can contribute to nephroprotection [8]. Diet should be the subject of particular attention in chronic renal failure [9]. It is therefore necessary to pay particular attention to the aggravation of chronic renal failure. The data on the assessment of the nutritional status of CKD patients is very limited in Burkina Faso.

Thus, the aim of this study was to evaluate the nutritional status of patients with CKD in nephrological consultations at Yalgado Ouedraogo University Hospital Center (YO-UHC) of Ouagadougou in Burkina-Faso.

MATERIALS AND METHODS

Patients

A total of Seventy-five patients were included in the study. The sampling principle of this study was to allow any voluntary patient to be selected. All patients with CKD admitted to the YO-UHC of Ouagadougou in Burkina Faso during the study period were included. This was a prospective study conducted over a period of eight months, among patients who came for nephrological care. The study population was composed of patients diagnosed with moderate or severe chronic renal failure. The volunteer patients admitted to the Nephrology-Hemodialysis Service (SNH) during the study period were considered. The non-inclusion criteria were any patient unable to answer the questions.

Ethics committee approval

The realization of this study was possible after the favorable opinion of the Ethics Committee for Health Research and the research authorization from the General Management of the YO-UHC and the Nephrology-Hemodialysis Service under the number: N°2017-022/MS/SG/CHUY-O/Nephro-Dialyse. Thus, free consent translated by a signature or digital borrowing of the patient was required before this study. The patients were informed of the objectives and interests of the study and that the results will only be used for research purposes. They were informed that confidentiality and anonymity would be respected. Appropriate nutritional advice was also provided to the surveyed patients as needed during the interview. Confidentiality and respect for professional secrecy have been implemented.

Data collection

Data were collected on a collection form using a standardised questionnaire, adjusted after a pre-survey. This questionnaire was developed according to the WHO STEPwise approach for Risk Factor Surveillance of chronic diseases or non-communicable diseases (STEPS) [10].

First, an interview lasting an average of 15 minutes was conducted with each patient in the study. During this interview, data on socio-demographic parameters including age, sex, place of origin, education level, socio-professional and economic level and personal and family history of CKD were collected.

Then, blood pressure was taken using an electronic blood pressure monitor on the left and right arm of each patient in a sitting or lying position, with the arm alongside the body. The clinical parameters were also recorded through the results of biological examinations carried out by each patient according to the laboratory of choice. Thus, creatinine, uricemia, fasting blood sugar, triglycerides, total cholesterol, HDL-cholesterol, LDL-cholesterol, and blood ionogram were noted. All these collected data were checked on the medical files of each patient.

Finally, anthropometric parameters were determined by taking anthropometric measurements, namely: weight, height, waist circumference and hip circumference. Weight was taken using an electronic adult scale of the SECA type, height was taken using a wall-mounted scale in the ward and waist and hip circumference were measured using a tape measure graduated in centimeters. These anthropometric data were used to diagnose the nutritional status of each patient as well as the distribution of body fat around the abdomen.

Statistical analysis

All statistical analyses were performed using Sphinx software and The Statistical Package for Social Science (SPSS) version 21 software. The level of significance used was $P<0.05$.

RESULTS AND DISCUSSION

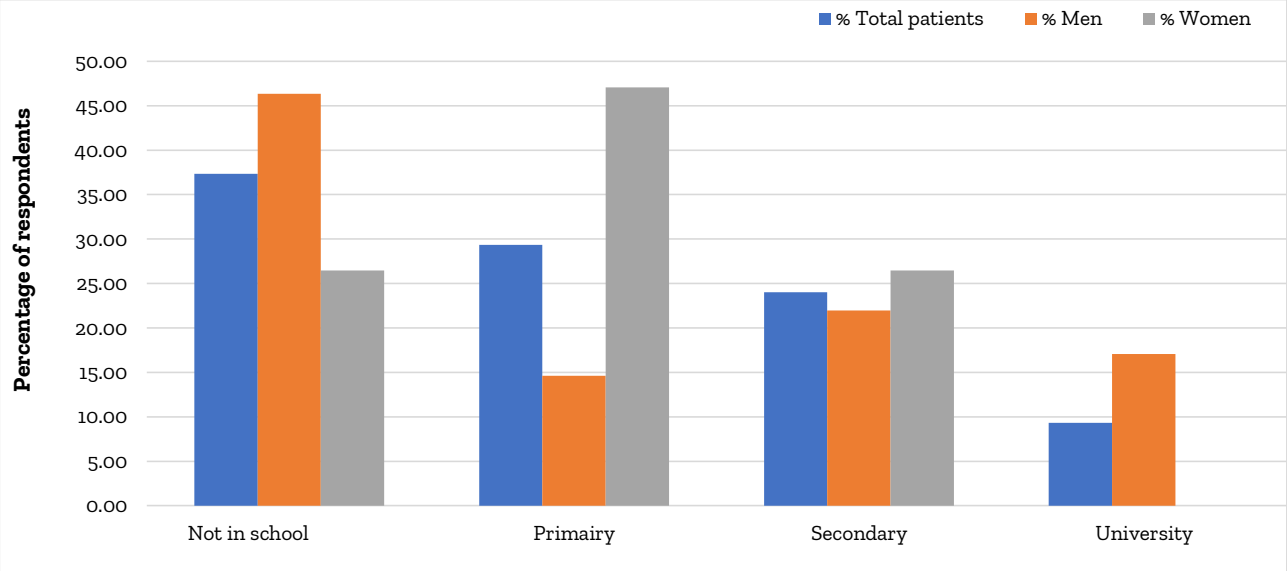
Socio-demographic parameters

Distribution of patients by gender and age group

The study involved 75 patients with 41 of men (54.70%) and 34 women (45.30%). The sample was predominantly male with a sex ratio (M/F) of 1.20. The results of sex ratios are the same of the studies of Guissou [11] and Skalli et al. [12] in Burkina Faso. This predominantly male trend was observed by Bah et al. [13], Ghonemy et al. [14] and Beaunoyer et al. [15] in 2013 in Canada. Kidney disease progresses more rapidly in men than in women [16]. According to Pouteil-Noble and Villar [17], the high frequency of kidney disease in men and their rapid progression to CKD is linked to gender. This could explain the predominance of nephrology. The lifestyle of men, who are more exposed to certain risk factors (drugs, tobacco, alcohol, inflammatory drugs and traditional medicines) and the role of hormones in women could explain this male predominance of CKD [15]. The average age of the patients surveyed was 60.80 years with extremes ranging from 32 to 85 years. The averages ages were 60.68 years and 60.94 years for men and women, respectively (P>0.05). Our results are slightly above those found by Traore [18] (50.4 years), Tapsoba [19] in Burkina Faso (55.5 years), Ngoie et al. [20] in the Democratic Republic of Congo (51.4 years) and Ghonemy et al. [14] in Egypt (52 years). These averages ages of our study reflect fairly well the increase in life expectancy in Burkina Faso which, according to the World Bank, rose from 49.9 years in 1998 to 60.3 years in 2016 and to 62 years in 2019 [21]. The most represented age groups were 60 to 69 years (33.33%) and 70 to 85 years (26.67%). These is because this age group is more likely to develop the diseases that are direct comorbidities associated with CKD, in contrast to the 30 to 39 age group (5.33%) which was the least represented.

Educational level

A rate of 37.33% of patients had no education. Our result is lower than the value 39.8% obtained by Tapsoba [19]. This reflects the fact that access to education is still an issue in our country. Also, the level of primary education of women and men are 47.06% and 14.63% Socio-demographic parameters, respectively (P<0.05). However, the number of men who had a university education was higher (9.33%) than that of women. Although the government authorities have made a lot of effort to get girls into school, the challenge remains for them to continue their studies at higher levels. Graph 1 shows the distribution of patients by level of education.



Graph 1. Distribution of patients by education level

Professional activity of patients

Most of the patients in the study population had a profession. The vast majority were those who were self-employed (26.67%), followed by pensioners (18.67%) and housewives (18.67%). This was followed by the group of civil servants (10.67%) and the group of unemployed (10.67%). Only the group of students had the lowest percentage (1.33%). This result is similar to the value of Kabore [22] who also found a low percentage for the student group (1.2%). The age range of this group could reflect this low prevalence. These results are presented in graph 2.

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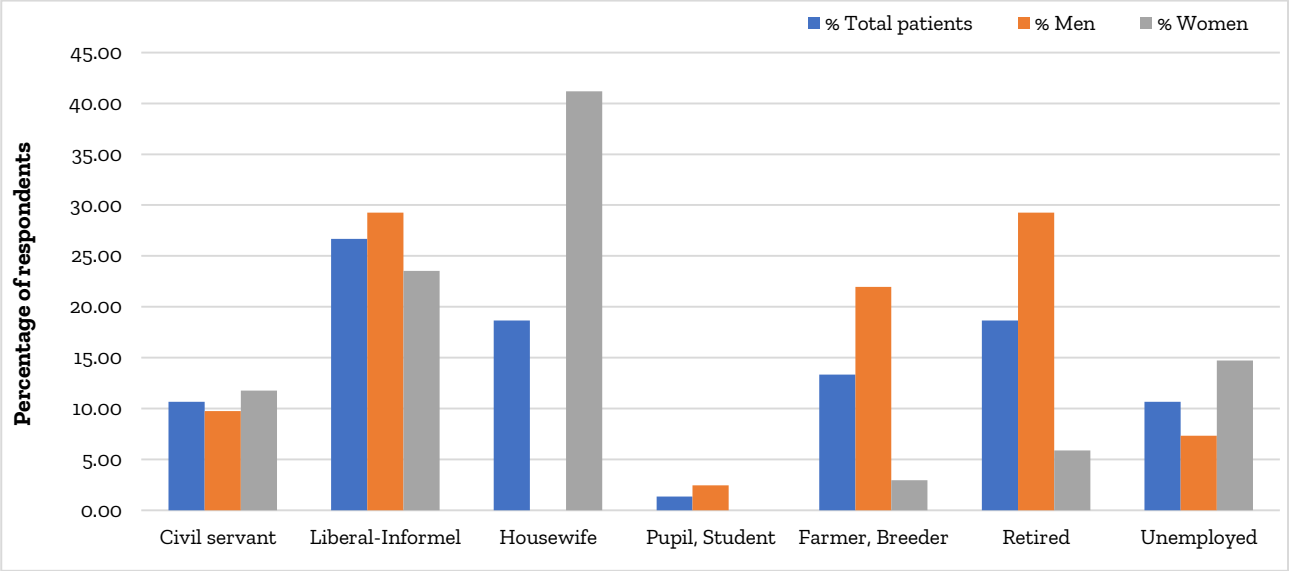
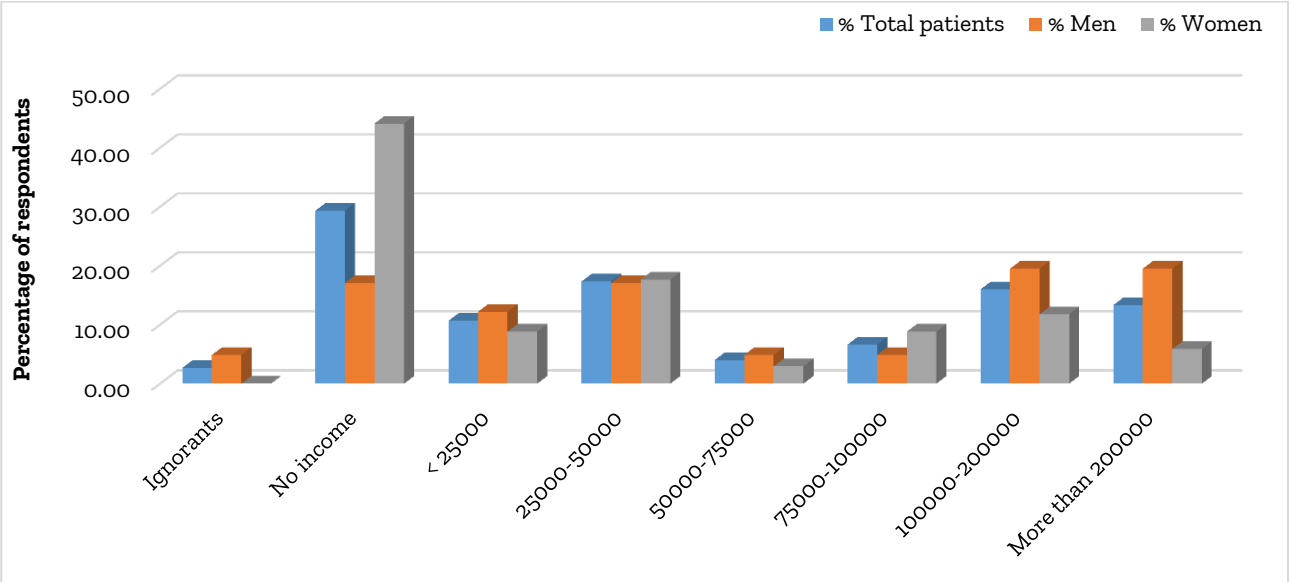


Graph 2. Distribution of patients by employment status

Economic situation of patients

A percentage of 97.33% of the patients who agreed to give an estimate of their monthly income, only 13.33% of the patients had a fairly high economic level (200,000 CFA). The percentages of monthly income of men and women are 19.51% and 5.88%, respectively (P>0.05). This indicates that the low financial empowerment of women in our country is still a reality. A percentage of 29.33% of patients have declared no monthly income, led by women (44, 12%). Our results corroborate those of Amekoudi et al. [23] in Togo who noted a high rate (57.1%) of the study population had a low socio-economic level. Indeed, this high rate of low socio-economic level of our patients reflects the level of poverty in which our populations live. Burkina Faso is ranked among the poorest countries in the world, according to the UNDP Human Development Report 2016 [24] which states that 46.4% of the Burkinabe population live below the poverty line [25]. This scourge exposes these patients to limited access to early care and good nutritional management. Graph 3 shows the distribution of patients by monthly income.

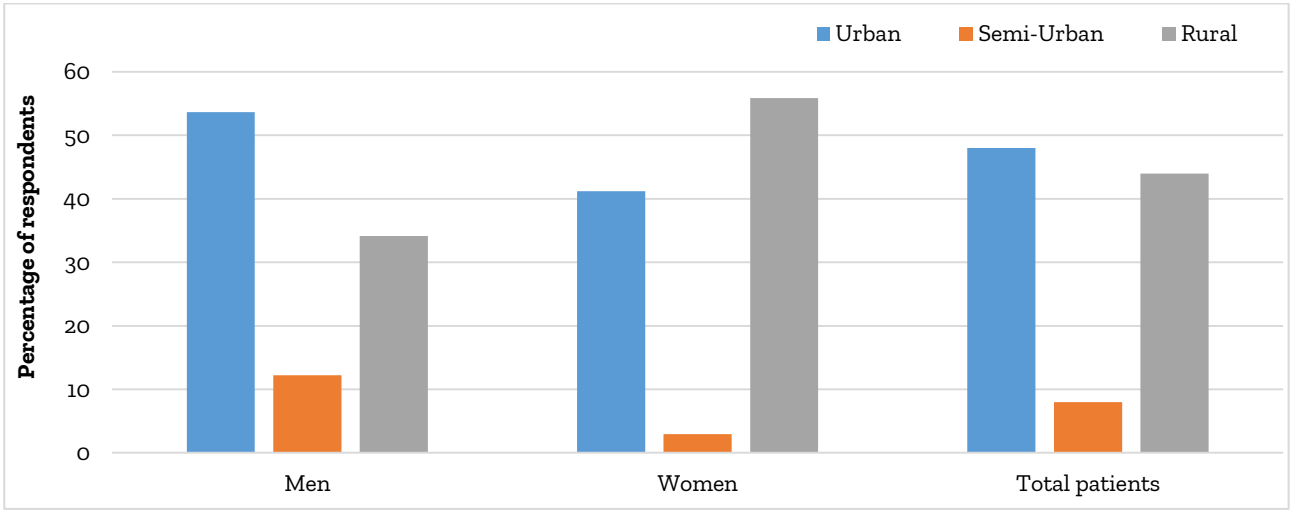


Graph 3. Distribution of patients by monthly income

Patients place of residence

Considering the place of residence, the highest frequency of patients came from the urban area, 48.00%, against 44.00% from the rural area and 8.00% from the semi-urban area. Our results from urban areas are lower than those of Guissou [26] (65.00%), while those from rural areas are higher (27.00%) and those from semi-urban areas are similar (8.00%). These results can be explained by the fact that the hospital has arbitrarily subdivided

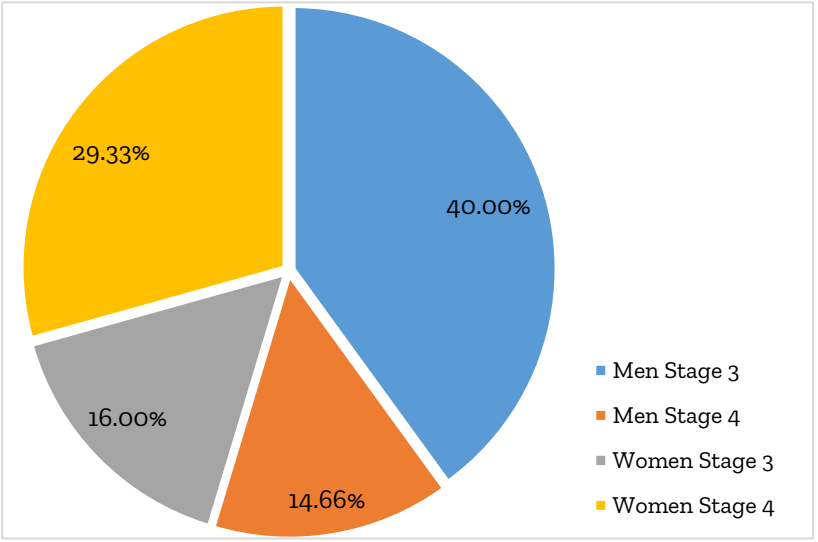
all patients coming from the outskirts of Ouagadougou fall into the semi-urban zone. Those from the interior are in the urban zone, and those coming from outside Ouagadougou in the other provinces are in the rural zone. It turns out that the interior of Ouagadougou and the provinces are much larger than the peripheries, which constitute a small area compared to the urban area of Ouagadougou and the rural areas. It should also be noted that the percentage of women (55.88%) in rural areas is higher than that of men (34.15%). This could be explained by the immigration of men to urban areas and outside the country in search of better living conditions. Overall, our results show a high rate of patients from urban areas compared to the value of 53.4% reported by Coulibaly et al. [26]. These results could be explained by the ease of access of urban residents to health centers, compared to those in rural areas who are more often limited by poverty and the difficulties of evacuating patients to urban areas. Graph 4 shows the distribution of patients by place of residence.



Graph 4. Distribution of patients by place of residence

Stages of CKD by gender

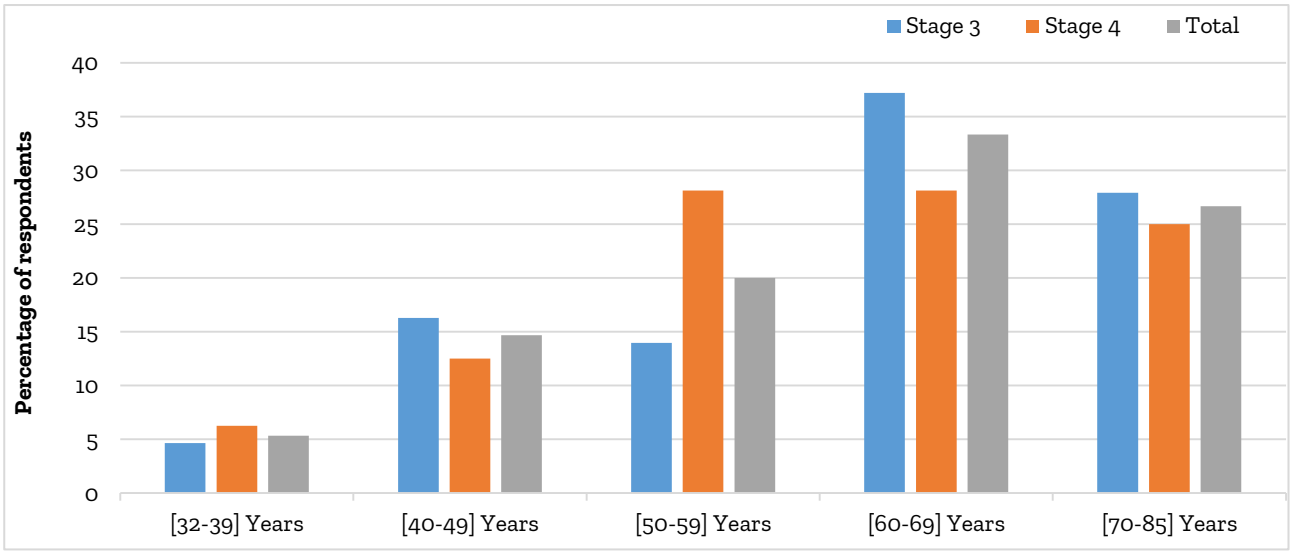
The percentage of men (40.00%) who were in stage 3 was higher than that of women (16.00%). In contrast, for stage 4, the percentage of women (29.33%) was almost twice that of men (14.66%). Chronic kidney disease progressed more in women than in men. However, according to some literature, men generally progress more rapidly to the severe stages of CKD than women [16, 27], with the exception of the post-menopausal period. However, the average age of the women in our sample was 60.94 years, therefore in the post-menopausal period, which could be a reason for this difference. Also, this difference could be explained by the fact that women had more comorbidities than men, particularly overweight (85.29% of women were abdominally obese compared to 36.59% of men). Indeed, our results showed that 88.24% of women had more adipose tissue compared to 75.61% of men. These results corroborate with those of Kabore who found a slower progression of GFR in class 2 in favour of men 1.6 mL/min/1.73 m2 (P=0.001) [22]. In addition, according to nephrologists, obese people are twice as likely to develop kidney disease [28]. The mean glomerular filtration rate (GFR) was 32.94 mL/min/1.73m^2 for men, which globally reflected a stage 3 CKD, and 24.25 mL/min/1.73m^2 for women, which globally reflected a stage 4 CKD (P<0.005). Graph 5 below shows the distribution of patients according to the stage of chronic renal failure and according to sex.



Graph 5. Distribution of patients according stage of chronic renal failure and according to sex

Stages of CKD progression by age group

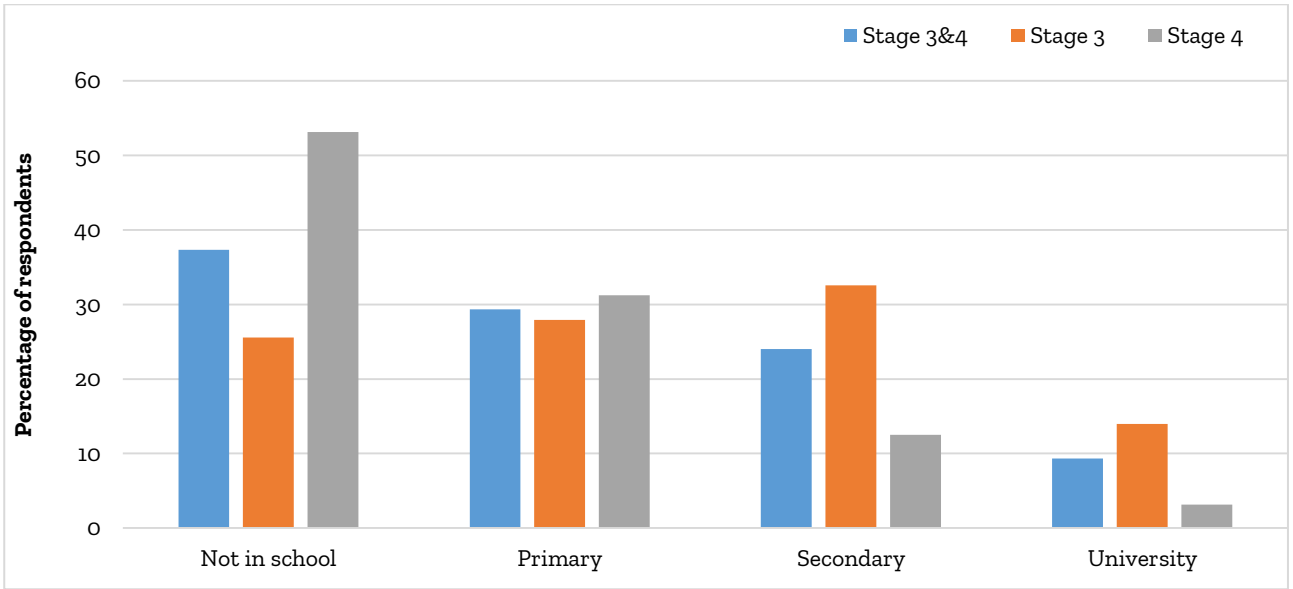
Overall, for all stages of chronic kidney disease (stages 3 and 4), the proportion of patients increased from the youngest (32-39) to the oldest (70-85) age group in our study. For both stages together (3 and 4), patients in the 70-85 age group outnumbered those in the 30-39 age group by five to one. The stage of CKD varied increasingly with age. Indeed, it is generally accepted that in the absence of CKD, renal function naturally decreases with age by 1 mL/min/1.73 m^2/year [28], which may explain our results. The distributions of the respondents according to the predominance of CKD by age group are presented in Graph 6.



Graph 6. Stages of CKD by age group

CKD stage by education level

The number of patients varied significantly with the level of education (P<0.05). The percentage of patients with no education was 37.33%. The percentage of uneducated patients was twice as high in stage 4 (53.13%) as in stage 3 (25.58%), in contrast to patients with university and secondary education. The latter had the lowest percentages in stage 4, 3.13% and 12.50% respectively. This difference could be explained by the relatively earlier management and follow-up of treatments in patients who are more educated than those who are not. Indeed, patients with a higher level of education tend to have a better understanding of chronic kidney disease than patients with a low level of education or even illiterate patients, some of whom even deny the disease. The fact that educated patients have a paid profession, and therefore the financial power to meet the cost of treatment, could explain the progression of CKD to stage 4 in the latter. The distribution of respondents by stage of CKD and by level of education is shown in graph 7.



Graph 7. CKD stage by education level

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Biological tests of the patients

Blood glucose

Table 1 shows the averages blood glucose levels by age group and sex of the respondents. The average fasting blood glucose of the CKD patients in our study was 5.69 mmol/L. Our results are similar to those reported by Tapsoba [19] (5.5 mmol/L). There was no significant difference according to sex (men: 5.77 mmol/L; women: 5.60 mmol/L; $p > 0.05$). The rate of normal blood glucose, hyperglycaemia and diabetes varied with age in our study. Indeed, as age increased, the proportion of patients with normal blood glucose levels decreased in favour of hyperglycaemic and diabetic patients. The proportion of patients with normal blood sugar levels fell from 100% in the 30-39 age group to 53.33% in the 70-85 age group. The proportion of moderate fasting hyperglycaemia was 16.67% in the 40-49 age group and 26.67% in the 70-85 age group. Diabetes occurs late in life and its prevalence increased with age. From 10% in the 50-59 age group, it doubled in the 70-85 age group. These results are supported by Bouattar in 2010 who stated that diabetes is a frequent pathology in the eldest. Its prevalence reaches 10 to 20% after the age of 65 [28]. The ageing of the population is one of the explanatory factors of this expected epidemic. Diabetes is therefore a risk factor for CKD as age increases. Indeed, previous results have shown that CKD increases with age. The proportions of diabetes, moderate hyperglycaemia, and fasting blood glucose by age group are shown in Table 2.

CKD stage by fasting blood glucose level

Hyperglycaemic and diabetic patients were equal at 13.45% for both stages. Indeed, according to Tapsoba [19] studies, the prevalence of diabetes is associated with CKD progression ($P<0.05$). The distribution of respondents by fasting blood glucose level (mmol/L) and CKD stage is shown in Table 3.

CKD stage and blood pressure level

For systolic blood pressure (SBP), stage 3 CKD has as many normal-SBP patients as hypertensive-SBP patients. However, in stage 4 CKD there is a clear difference between normal-PAS (38.71%) and hypertensive-PAS (61.29%) patients. This draws our attention to the influence of increasing systolic blood pressure (SBP) on the evolution of CKD or vice versa. Regarding diastolic blood pressure (DBP), we did not notice any significant differences between the numbers of CKD 3 and 4 patients at the two types of DBP (Normal-BPD and Hypertensive-BPD). Indeed, the percentages were almost identical for Normal-PAD CKD 3 (82.00%) and 4 (80.65%). The same was true for Hypertensive-DAP at CKD stage 3 (20.50%) and stage 4 (19.72%). This could mean that diastolic blood pressure has no adaptive variation at CKD stage. Indeed, Halle et al. [29] in their study, reported that 82.8% of patients who would have been seen at an advanced stage of their disease had high blood pressure (170.9 mm Hg for SAP and 103.8 mm Hg for DBP). High blood pressure accompanies most kidney diseases and is the main risk and progression factor [30; 31]. The different data are shown in table 4.

Table 1. Average of blood glucose level by sex and age group

Average of blood glucose level / Age groups	Total (n = 52)	Men (n = 28)	Women (n = 24)
30-39	4.78 ± 0.30	4.70 ± 0.39	4.92 ± ND
40-49	5.27 ± 0.8	5.42 ± 1.06	4.97 ± 0.35
50-59	5.39± 1.26	4.34 ± 0.77	5.65 ± 1.25
60-69	5.88 ± 1.49	6.33 ± 1.62	5.03 ± 0.58
70-85	6.00 ± 1.16	5.73 ± 0.93	6.30 ± 1.38
30-85	5.69 ± 1.26	5.77 ± 1.36	5.60 ± 1.16

The mean blood glucose values are expressed as m ± SD (Standard deviation in mmol/L); ND= Not determined; n = number

Table 2. Diabetes and fasting blood glucose levels by age group

Age groups / Diabetes and fasting blood glucose levels (mmol/L)	30-39 n (%)	40-49 n (%)	50-59 n (%)	60-69 n (%)	70-85 n (%)	30-85
Diabetes	0	0	1(10.00)	3(16.67)	3(20.00)	7(13.50)
Moderate hyperglycaemia	0	1(16.67)	1(10.00)	1(5.56)	4(26.67)	7(13.50)
Normal blood sugar	3(100)	4(83.33)	8(80.00)	14(77.78)	8(53.33)	38(73.10)

Normal fasting blood glucose (≤ 6.1 mmol/L); Moderate fasting hyperglycaemia (6.2 to 6.9 mmol/L); Diabetes (≥ 7 mmol/L at two consecutive diagnoses).

Table 3. Distribution of respondents by fasting blood glucose level and CKD stage

Fasting blood glucose (mmol/L)	Stage 3 n (%)	Stage 4 n (%)	Total n (%)
Normal	20 (38,46)	18 (34,61)	38 (73.07)
Hyperglycaemia	04 (07,69)	03 (05,76)	07 (13,45)
Diabetes	06 (11,53)	01 (1,92)	07 (13,45)

n= number; p > 0.05

Table 4. Distribution of respondents by CKD stage and blood pressure level

Blood pressure level (mm Hg)		Stage 3 n(%)	Stage 4 n(%)	Total n(%)
Systolic Blood Pressure	Normal	20 (50.00)	12 (38.71)	32 (45.07)
	Hypertensive	20 (50.00)	19 (61.29)	39 (54.93)
Diastolic Blood Pressure	Normal	32 (82.00)	25 (80.65)	57 (80.28)
	Hypertensive	08 (20.50)	06 (19.72)	14 (19.72)

Blood pressure level: Normal PAS < 140 mm Hg; Hypertensive PAS ≥ 140 mm Hg; Normal DBP < 90 mm Hg; Hypertensive DBP ≥ 90 mm Hg; n= number; r = 0.941

Family history

A percentage of 67.99% of the patients had a history of hypertension either from first-degree relatives (father or mother) or collaterals. Our results corroborate with those of Coulibaly [26] who found 69.9% family history of hypertension. However, the highest proportion was among hypertensive collaterals (37.33%). This could be due to the ignorance of the clinical picture of the direct relatives of the patients in our study and also the fact that many of them lost their parents early on due to undiagnosed diseases. The vast majority of the hypertensive collaterals are still alive, many of them are also followed up in health centers. In sum, the high proportion of patients with a history of hypertension is a reflection of the epidemiological and dietary transition [10; 31]. The distribution of family history of hypertension is shown in Table 5.

Table 5. Results of family history of hypertension

Family history	Total. n (%)	Men. n (%)	Women. n (%)	p-value
	51 (67.99)	30 (73.17)	21 (61.77)	
Father hypertensive	13 (17.33)	8 (19.51)	5 (14.71)	0.405
Hypertensive mother	10 (13.33)	3 (7.32)	7 (20.59)	0.206
Hypertensive collaterals	28 (37.33)	19 (46.34)	9 (26.47)	0.049

There was a significant difference between hypertensive collaterals (p<0.05), but not with first-degree relatives; n= number

Self-medication of patients before the discovery of CKD

According to the WHO, self-medication is when an individual uses a medicine on their own initiative to treat a self-identified condition or symptom, without consulting a health professional [32]. Thus, 69.33% of the patients surveyed claimed to be self-medicating before they knew they had kidney failure. The use of anti-inflammatory drugs was observed in 37.77% of patients, followed by the use of traditional products in 32.69%, and analgesics in 28.85% of patients. Our results confirm those of Coulibaly in 2018, who also reported the use of NSAIDs, meaning anti-inflammatory drugs, in 24.4% (n=165 patients), and the use of phytotherapy in 26.7% (n=181 patients) [26]. The use of anti-inflammatory drugs and traditional products in unknown doses would have an impact on the deterioration of renal function [33]. The distribution according to the therapeutic classes of drugs is shown in Table 6.

Table 6. Distribution of drugs by therapeutic classes

Medicines	Number	Percentage
Anti-inflammatories	16	37.77
Analgesics	15	28.85
Anti-malarials	4	7.69
Traditional products	17	32.69

There was a significant difference between patients taking Anti-inflammatories and Anti-malarials as well as between taking Traditional and Anti-malarials at the P<0.05 probability level

Summary of blood tests

Creatinine measurement was performed in all patients, as this test was essential to assess the status and/or evolution of the patients' renal failure. The creatinine average was 229.47 µmol/L, reflecting the presence of stage 3 CKD with an average age of 60.80 years for male patients and stage 4 CKD for female patients. The results showed that the patients had an average value of hyper-uraemia, hyper-uricaemia, hyper-calcaemia and high proteinuria with respective values of 11.79 mmol/L; 479.52 µmmol/L; 3.04 mmol/L and 1.01 g/24 h. These ionic imbalances are one of the consequences of the disturbances in phosphocalcium metabolism, bone metabolism and acid-base balance that occur during CKD [34]. The haemoglobin was below normal at 11.59 g/dL for both sexes. In fact, in patients with renal failure, a diet that is too low in protein can lead to iron deficiency and aggravate a tendency to anaemia. When dietary iron intake is reduced, iron supplementation will be necessary. In addition, treatment with erythropoietin (EPO) requires adequate iron intake. Medical prescriptions followed by nutritional advice were given to these patients in order to promote good health. The results of the biological analyses are shown in Table 7.

Table 7. Distribution of drugs by therapeutic classes

Biological tests	N	Average ± SD	Threshold value
Creatinine (µmol/L)	75	229.47 ± 85	62.0 – 120.0
Cholesterol (mmol/L)	24	4.73 ± 1.77	3.5 – 6.45
HDL cholesterol (mmol/L)	24	1.80 ± 1.02	> 1.10
LDL cholesterol (mmol/L)	24	2.60 ± 1.46	< 3.4
Triglycerides (mmol/L)	20	4.93 ± 14.48	0.46- 1.88
Fasting blood glucose (mmol/L)	52	5.68 ± 1.26	4.16- 5.9
Urea (mmol/L)	65	11.79 ± 5.53	2.51- 7.52
Uric acid (µmmol/L)	66	479.52 ± 5.53	M:202-416 ; W:142- 339
Ca (mmol/L)	66	3.04 ± 2.19	2.15 -2.55
Phosphate (mmol/L)	53	1.34 ± 0.75	0.81 – 1.60
Magnesium (mmol/L)	64	0.89 ± 0.28	0.65 – 1.05
Sodium (mmol/L)	65	137 ± 6.33	135 -155
Kalemia (mmol/L)	66	4.09 ± 0.86	3.5 5.1
Chlorine (mmol/L)	63	100.76 ±14.30	85 -115
Bicarbonate (mmol/L)	49	21.93 ± 3.60	22 – 29
Total protein (g/L)	63	74.68 ± 12.09	66 – 87
Haemoglobin (g/dL)	53	11.59 ± 2.15	H : 13-17 ; F : 12-17
Proteinuria (g/24 h)	32	1.01 ± 1.52	< 0.1
ECBU	4	+	

SD= Standard deviation; N= Number of patients; HDL= High-density lipoproteins; LDL= Low-density lipoproteins; ECBU= Cytobacteriological examination of urine

Nutritional status of patients in relation to CKD stage

Body Mass Index (BMI) level and gender

According to the WHO, the limits of a "normal" BMI are between 18.5 and 24.9 kg/m^2 [35]. A BMI below 18.5 kg/m^2 defines a state of malnutrition, above 25 indicates a state of overweight and above 30, an obese state. BMI is the key parameter and was assessed in all patients. Thus, the average BMI of the patients was normal (24.79 Kg/m^2) in 46.67% of the patients. Our results corroborate those of Coulibaly in 2018 [26] and Tapsoba [19] also reported a normal average BMI of 24.5 Kg/m^{2}and 23.6 Kg/m^{2}respectively in 18.51% and 67.5% of the patients [26 ; 19]. Leanness was observed in only 09.33% of the patients. This is approximately equal to the value 8.9% reported by Tapsoba [19]. This finding would be due to the early onset of undernutrition in these patients. However, 30.67% of the patients in our study were overweight and 13.33% were obese. The percentage of men (58.54%) who had a normal BMI was significantly higher than women (32.35%) (P<0.05). In contrast to normal BMI, the propensity of overweight and obesity in females was higher than in males. A percentage of 64.71% females were overweight or obese versus 26.83% for males. Tapsoba [19] found that 13% of patients were overweight and 10.6% obese. This high prevalence of obesity in our developing countries could be explained by the adoption of deleterious dietary behaviours, notably a total lack of awareness of the intake of large quantities of energy-dense foods, but also by the rise in the socio-economic level of the populations. For Yusuf et al. [36], the predominance of overweight in women is also due to a sedentary lifestyle and cultural conceptions that favour this phenomenon. Obesity favours an increase in renal blood flow, causing glomerular hyper filtration

[37]. Yamagata et al. [38] suggest that obesity is an increased risk for early CKD. Even if the prevalence of obesity in Burkina Faso is low compared to other countries, 4.5% for the population aged 25-64 years [39]. It is imperative to take preventive measures [40] to reduce the incidence of kidney disease related to this condition. Table 8 gives a breakdown of respondents by BMI level and gender.

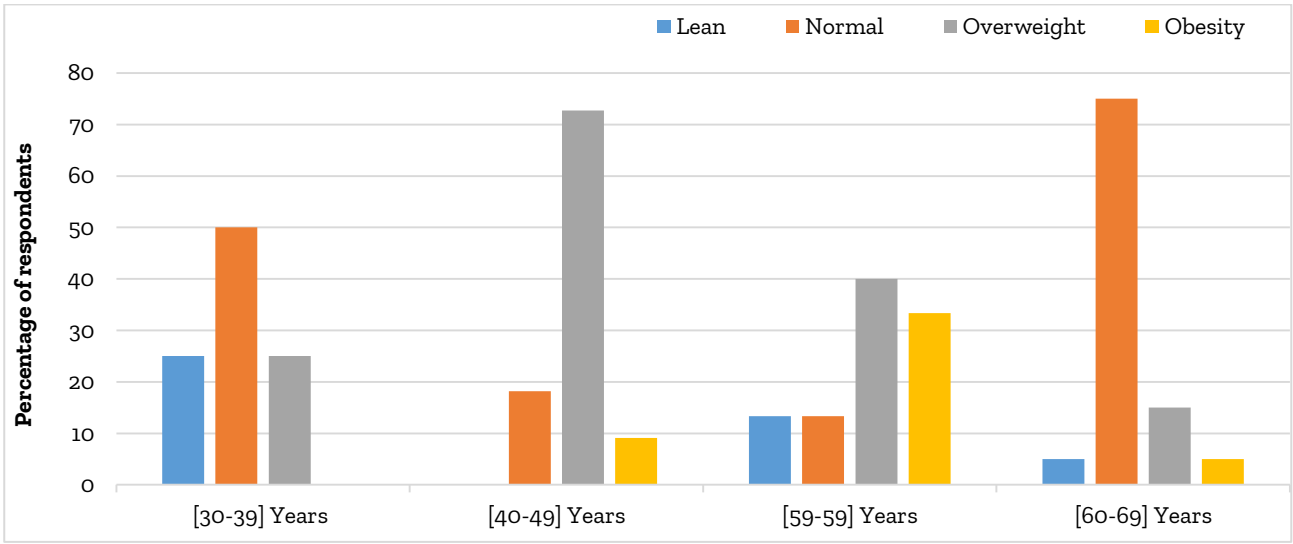
Table 8. Distribution of drugs by therapeutic classes

Body Mass Index	Total. n(%)	Men. n(%)	Women. n(%)	P-value
Lean	07 (09.33)	06 (14.63)	01 (02.94)	ND
Normal	35 (46.67)	24 (58.54)	11 (32.35)	0.028
Overweight	23 (30.67)	08 (19.51)	15 (44.12)	0.144
Obese	10 (13.33)	03 (07.32)	07 (20.59)	0.206
Average BMI in Kg/m^2	24.79 ± 4.84	23.44 ± 4.22	26.43 ± 5.09	0.007

Data are expressed as n (%); Averages are expressed as m ± SD (Standard Deviation); BMI = Body Mass Index; ND= Not determined ; n = number of patients

BMI level and age group

The level of BMI varied considerably, depending on the age group. The proportions of overweight and obesity were higher in the 40-49 and 50-59 age groups. For overweight, the proportion was 72.73% in the 40-49 age group compared to 40% in the 50-59 age group. For obesity, the proportion was highest (33.33%) in the 50-59 age group. This could be explained by lifestyle, including sedentary or physically inactive lifestyles and also by dietary habits [37-41]. Indeed, it is at this stage of life that many people manage to stabilize themselves on the socio-economic level in our context. They are able to afford a wide range of rich and varied foods that unfortunately will exceed their energy needs, leaving room for overweight. It is also at this age that the menopause sets in slowly for most women, which also leads to overweight. In contrast to the proportion of patients with normal status, the proportion first decreases between the ages of 40 and 59 and then increases after 59 years. This phenomenon could be explained by the weight of age. Indeed, ageing is accompanied by a collapse of fat mass to the profile of lean mass. Graph 8 shows the distribution of respondents by BMI level and age group.



Graph 8. Distribution of respondents by BMI level and age group

CKD stage by BMI level

A percentage of 46.67% of patients had a normal BMI compared to 44% who were overweight or obese. In addition, the percentage of obese patients in stage 4 was twice that of stage 3. Indeed, at the 12th World Kidney Day to Burkina Faso, Nephrologists stated that obese people are twice as likely to develop kidney disease to 2017. This statement supports our findings that 44% of chronic kidney disease patients are overweight or obese [38]. The proportions of patients with a BMI below 18.5 were equal at both stages. These results can be explained by the fairly early onset of undernutrition in the lives of these patients. The distribution of respondents by BMI level and CKD stage is shown in Table 9.

Table 9. Distribution of respondents by BMI level and CKC stage

BMI signification	Stade 3. n (%)	Stade 4. n (%)	Total. n (%)
Lean	04 (09.30)	03 (09.38)	07 (09.33)
Normal	21 (48.84)	14 (43.75)	35 (46.67)
Overweight	14 (32.56)	09 (28.13)	23 (30.67)
Obesity	04 (09.30) *	06 (18.75) *	10 (13.33)

BMI= Body Mass Index ; Comparisons are made between stage 3 and stage 4 BMIs at the probability threshold of P<0.05 (*).

Waist and hip circumference

The average waist circumference of the patients was 91.60 cm. The average hip circumference was 93.77 cm, with a significant difference according to sex (P<0.05). The highest average waist and hip circumferences were in the age range of 50-59 years (WC = 99.67 m and HC = 104.73 m). The average waist circumference of the subjects aged 30-39 years was significantly lower than that of the subjects aged 60-85 years. These values indicate that abdominal fat mass increased with increasing age. This fat deposition could be related to the stage of progression of CKD. The average values of the measured waist and hip circumferences are presented in table 10.

Table 10. Distribution of respondents by BMI level and CKC stage

Item		Average WC (cm)	Average HC (cm)
Gender	Men	87.10 ± 15.54^{a}	88.49 ± 13.10^{a}
	Women	97.03 ± 19.43^{a}	100.15 ± 18.25^{b}
Age group	30-39	67.75 ± 25.64^{b}	76.50 ± 29.49^{a}
	40-49	96.09 ± 15.58^{a}	102.18 ± 13.58^{ab}
	50-59	99.67 ± 24.29^{a}	104.73 ± 19.85^{ab}
	60-69	91.60 ± 13.02^{ab}	90.32 ± 09.33^{b}
	70-85	87.85 ± 13.52^{ab}	88.70 ± 13.98^{b}
	Total	91.60 ± 17.99	93.77 ± 16.59

Averages are expressed as m ± SD. Means in the same column with different superscripts are significantly different at P<0.05 according to the ANOVA test; WC= Waist Circumference; HC= Hip Circumference; ab= P < 0.05; a or b= p > 0.05

Waist circumference and waist to hip ratio

Considering overweight or obesity, waist circumference and the distribution of overweight allows us to assess abdominal fat deposits, which are a factor of cardio-metabolic complications during chronic renal failure. Thus, abdominal fat was significant in 58.67% of patients. Abdominal obesity of women was predominant (85.29%) against 36.59% for men. Yaméogo et al. [42] had reported in Bobo Dioulasso more or less the same trend (85.4% of women and 30.2% of men). In our study, abdominal obesity increased from 25% in the 32-39 age group to 73% in the 50-59 age group. According to gender, the distribution of fat tissue was abnormal. The percentages are 67.07% and 41.04% for women and men, respectively. This could be explained by the fact that women are particularly prone to obesity due to their body composition. The percentage of subjects with an abnormal distribution of adipose tissue increased with age. It increased from 50% in the 30-39 age group to 84% in the 60-69 age group. It is recognised that after the menopause, fat tends to be deposited on the upper part of a woman's body, resulting in abdominal obesity [42]. The distribution of respondents by sex, age group, waist circumference (WC) and waist to hip ratio thresholds is shown in Table 11.

Table 11. Distribution of respondents by gender, age group and waist circumference and waist to hip ratio thresholds

Item		Waist Circumference		WC / HC ratio	
		Normal	Abdominal obesity	< limit	≥ limit
Sex	Men	26 (63.41)	15 (36.59)	10 (24.39)	31 (75.61)
	Women	05 (14.71)	29 (85.29)	04 (11.76)	30 (88.24)
	Total	31 (41.33)	44 (58.67)	14 (18.67)	61 (81.33)
Age groups	32-39	03 (75.00)	01 (25.00)	02 (50.00)	02 (50.00)
	40-49	04 (36.37)	07 (63.63)	02 (18.18)	09 (81.82)
	50-59	04 (26.67)	11 (73.30)	06 (40.00)	09 (60.00)
	60-69	10 (40.00)	15 (60.00)	04 (16.00)	21 (84.00)
	70-85	10 (50.00)	10 (50.00)	10 (50.00)	10 (50.00)

Waist circumference: normal (< 80 cm for women; < 94 cm for men) and abdominal obesity (≥ 80 cm for women; ≥ 94 cm for men); Waist to hip circumference ratio: Threshold (0.85 for women; 0.90 for men)

Physical activity level of patients

According to the French High Authority on Health, sport is beneficial to health when it is repeated at least three times a week [44]. In this study, 38.67% of the patients (n=29) practiced regular physical activity, compared to 61.33% of the patients who did not. There was no significant association between the practice of sport and the stage of renal failure (P>0.05). A percentage of 34.48% of patients reported having at least 3 to 4 sessions per week and only 31.03% spent more than 30 minutes per session doing sports. The proportion of patients meeting the minimum standard of sports practice was very low in our study [43; 45]. This could be explained by the fact that many patients are not aware of the benefits of sports activity. Table 12 summarises the distribution of respondents by stage of CKD and by physical activity.

Table 12. Distribution of respondents by CKD stage and physical activity

Item		Stade 3 n(%)	Stade 4 n(%)	Total n(%)	P-value
Sports activities	Yes	16 (37.21)	13 (40.63)	29 (38.67)	0.47
	No	27 (62.79)	19 (59.38)	46 (61.33)	
Number of sessions per week of practitioners	1-2 times/week	06 (37.50)	08 (61.54)	14 (48.28)	0.33
	3 - 4 times/week	06 (37.50)	04 (30.77)	10 (34.48)	
	More than 4 times/week	04 (27.00)	01 (07.69)	05 (17.24)	
Number of time spent by practitioners	15 to 30 minutes	11 (68.75)	09 (69.23)	20 (68.97)	0.64
	More than 30 minutes	05 (31.25)	04 (30.77)	09 (31.03)	

Comparisons are made between the level of frequency of sports activities of patients in stage 3 and stage 4 at the probability threshold of P<0.05

CONCLUSION

Chronic kidney disease is a serious, progressive and long silent disease present in Burkina Faso. This study made it possible to describe the socio-demographic characteristics, the stages of evolution of CKD, in particular the moderate and severe stages in relation to the socio-demographic characteristics, the clinical parameters associated with the stages, before determining the nutritional status of the patients in the study according to the said stages. The results showed that the average age of the patients was 60.80 years and that the male gender was the most affected by renal pathology. Access to education is still a problem in our country, with women having the lowest level of education. Patients from urban areas were more represented than those from other areas. The influence of increased systolic blood pressure on the progression of CKD and an association of family history of high blood pressure in patients in this study is also noted. More than half of the patients resorted to self-medication, particularly the use of non-steroidal anti-inflammatory drugs and traditional products in unknown doses. The percentage of men in stage 3 was higher (35%) than that of women (21%). In contrast, for stage 4, the percentage of women (29%) was significantly higher than that of men (15%). Chronic kidney disease (CKD) progressed more in women than in men. The comorbidities found in women could explain this fact. The average BMI of the patients was 24.79 Kg/m^2. The percentage of men with a normal BMI was significantly higher than that of women (58.54% versus 32.35%). Continuous monitoring of nutritional status and a relatively annual health check-up would minimize complications on renal function and optimize health well-being. Further prospective studies on dietary habits would allow for better monitoring of the nutritional status of patients and thus the general population.

DECLARATIONS

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Authors' contribution

T.H. Lengani wrote the original draft of the manuscript. T.H. Lengani, G. Sanou, S. Bougma, Y.A. Sawadogo, S. Zio organized the data, helped in writing and review of the manuscript. H.F. Ba, G. Coulibaly and A. Savadogo supervised the study and validated the review of the manuscript. All authors have read and approved the final version.

Competing interests
All the authors consented to the publication of this manuscript. The authors declare no conflict of interest.

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