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Evaluation of the Prevalence and Associated Factors of Sarcopenia in Patients on Hemodialysis in Dakar, Senegal in 2025

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Abstract

Introduction: In Africa, particularly in Senegal, sarcopenia among patients undergoing hemodialysis remains insufficiently studied. In this context, we conducted this study with the objective of describing the epidemiological and etiological aspects of sarcopenia among hemodialysis patients in Dakar in 2025. **Patients and Methods:** We carried out a multicenter, cross-sectional, descriptive and analytical study over a 15-day period in four hemodialysis centers in Dakar. Sarcopenia was diagnosed according to the diagnostic criteria of the EWGSOP2 working group. A cluster sampling of hemodialysis centers was performed, followed by stratified sampling by dividing patients into two groups: younger patients (<65 years) and older patients (≥65 years). All patients on chronic hemodialysis for at least three months were included. **Results:** A total of 152 patients were included. The mean age was 47.88 ± 13.68 years. There were 77 men (50.7%) and 75 women (49.3%), with a sex ratio of 1.02. The mean body mass index (BMI) was 20.72 ± 4.91 kg/m^2 (range: 12.65 - 38.39), and 23.7% of patients had a BMI < 18.5 kg/m^2. The mean serum ferritin level was 829.73 ± 778.4 pg/mL. Based on the SARC-F questionnaire, sarcopenia was suspected in 55 patients. Handgrip strength was reduced in 82 patients (53.94%), including 38 men and 44 women. Bioelectrical impedance analysis confirmed sarcopenia in 64 patients, yielding a prevalence of 42.10% (95% IC: [34.4% - 50.10%]). Thirty patients presented with severe sarcopenia.

In multivariate analysis, factors independently associated with sarcopenia were male sex (OR = 5.98; 95% CI: 2.27 - 15.74), undernutrition (BMI < 18.5) (OR = 6.25; 95% CI: 2.08 - 18.74), and overweight (BMI > 25) (OR = 0.06; 95% CI: 0.01 - 0.49). **Conclusion:** Sarcopenia is common among hemodialysis patients in Dakar. Male sex, and undernutrition are significant risk factors. A prospective cohort study would be relevant to better assess its prevalence, risk factors, and prognostic impact.

Keywords

Sarcopenia, Hemodialysis, Undernutrition, Sub-Saharan Africa

1. Introduction

The term sarcopenia was initially used to describe age-related loss of skeletal muscle mass. Its current definition has been expanded to include muscle loss associated with chronic diseases, physical inactivity or reduced mobility, and malnutrition [1]. Reported prevalence varies widely across studies, ranging from 4% to 68%, largely due to differences in diagnostic criteria, study methodologies, and the populations investigated [2] [3]. In patients undergoing dialysis, sarcopenia is associated with a significantly increased risk of mortality [3]. It is also linked to a higher risk of major adverse cardiovascular events and a trend toward increased hospitalization rates in this population [4]. In Africa, particularly in Senegal, sarcopenia among hemodialysis patients remains insufficiently studied. It is within this context that we conducted the present study, with the objective of describing the epidemiological and etiological aspects of sarcopenia in patients receiving hemodialysis.

2. Patients and Methods

2.1. Study Design

This was a multicenter, cross-sectional, descriptive, and analytical study. The study was conducted over a 15-day period, from November 5 to November 20, 2025, in four hemodialysis centers in Dakar (Pikine Hemodialysis Center, Dalal Jamm Hospital, Hangar des Pèlerins Hemodialysis Center, and Roi Baudouin Hemodialysis Center). Diagnostic Criteria for Sarcopenia The diagnosis of sarcopenia was established according to the diagnostic criteria of the EWGSOP2 working group. The diagnostic process followed four sequential steps [5]: 1) SARC-F Questionnaire: The first step consisted of screening for sarcopenia using the SARC-F questionnaire. A score ≥ 4 was considered suggestive of sarcopenia; 2) Assessment of Muscle Strength: Muscle strength was assessed by measuring handgrip strength using a dynamometer for all patients. Low muscle strength was defined as a handgrip strength < 27 kg in men and <16 kg in women; 3) Confirmation of the Diagnosis: In this study, muscle mass was assessed using bioelectrical impedance analysis for all patients. The Appendicular Lean Mass Index (ALMI) is a body composition indicator that measures lean mass of the limbs (arms and legs), excluding fat and bone, and is standardized to height squared (ALM/height^2), expressed in kg/m^2. Sarcopenia was confirmed when ALMI was <7.0 kg/m^2 in men and <5.5 kg/m^2 in women; 4) Severity of Sarcopenia The fourth step assessed the severity of sarcopenia using the 400-meter walk test. A walking time of more than 6 minutes to complete the 400 m or inability to complete the distance was considered indicative of severe sarcopenia.

Study Population Sampling: for the sample size calculation, Schwartz's formula was used.

Calculation of the required sample size:

$$N = t\alpha^2 \times P(1 - P)/E^2$$

$$\alpha = 5\%$$

P = prevalence of sarcopenia. The estimated prevalence was 9% [3].

E = 5% (precision)

Thus, the required sample size was N = 126 participants.

2.2. Sampling Method

We carried out a stratified sampling by randomly selecting hemodialysis centers in the Dakar region that regularly managed patients. A total of nine centers were identified, including seven public and two private centers. Following the sampling process, four hemodialysis centers were selected: the hemodialysis centers of Hôpital Dalal Jamm, Hôpital Pikine, Hôpital Roi Baudoin, and Hangar des Pèlerins. All patients from these four centers who met the inclusion criteria were included in the study. Subsequently, a stratified sampling approach was applied by dividing patients into two groups: younger patients (<65 years) and older patients (≥65 years). The number of subjects in each stratum was determined according to the proportion of younger and older individuals in the hemodialysis population of Dakar, estimated at 85% and 15% [6], respectively. Inclusion Criteria: all patients undergoing chronic hemodialysis for at least three months were included. Exclusion Criteria: patients younger than 15 years of age; patients unable to respond to the questionnaire; patients unable to stand on the bioelectrical impedance device (e.g., amputees, patients with fractures); patients with cardiac pacemakers.

2.3. Study Procedure

Data were collected using a pre-established data collection form in which the following parameters were recorded. The interview focused on age, medical history, number of meals per day, and the presence of anorexia, after which patients completed the SARC-F questionnaire. A clinical examination was performed for each patient. Handgrip strength was assessed using an EH 106 dynamometer. Subsequently, muscle quality and quantity were evaluated through body composition measurements using bioelectrical impedance analysis to confirm the presence of sarcopenia, employing a TANITA bioelectrical impedance analyzer (model RD-545-HR). The device is equipped with four sensors (plantar electrodes) integrated into the measuring platform. Measurements were performed barefoot, in a standing position, under standardized conditions according to the manufacturer's recommendations. Bioelectrical impedance measurements were carried out on dialysis days, after the hemodialysis session. Once sarcopenia was confirmed, its severity was assessed using a muscle function test (walking speed).

2.4. Statistical Analysis

Data analysis was carried out with SPSS (Statistical Package for Social Sciences) version 21 software. The descriptive study was carried out with the calculation of frequencies and proportions for the qualitative variables and the calculation of the means and standard deviations for the quantitative variables. The analytical study was done with cross tables. To compare the frequencies, we used the Pearson chi-square test or the bilateral Fisher exact test depending on their conditions of applicability; the comparison of the means was made with the analysis of variance test with a threshold of significance of $p < 0.05$. In multivariable analysis, binomial logistic regression with the stepwise method was used. This method consists of eliminating non-significant variables one by one in the model. Variables associated with sarcopenia with a p-value < 0.20 in bivariate analysis, as well as those considered clinically relevant, were included in a multivariate logistic regression model. The significance threshold used in this work is $p < 0.05$.

3. Results

A total of 152 patients were included in this study (**Figure 1**). The mean age was 47.88 ± 13.68 years, and 131 patients (86.2%) were younger than 65 years. There were mostly male (77% or 50.7%) yielding a sex ratio of 1.02. Benign nephroangiosclerosis was the underlying cause of kidney disease in 47.4% of cases. The

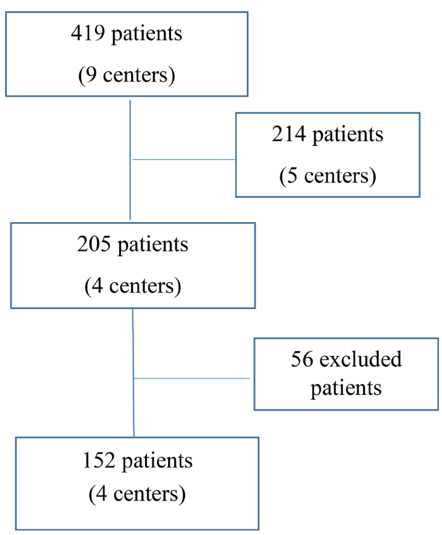

Figure 1. Flowchart diagram for the selection of the patients.

mean duration of hemodialysis was 7.59 ± 4.45 years. The mean body mass index (BMI) was 20.72 ± 4.91 kg/m^2 (range: 12.65 - 38.39), and 23.7% of patients had a BMI < 18.5 kg/m^2. The mean serum ferritin level was 829.73 ± 778.4 pg/mL (Table 1). Based on the SARC-F questionnaire, sarcopenia was suspected in 55 patients. Handgrip strength was reduced in 82 patients (53.94%), including 38 men and 44 women. Bioelectrical impedance measurements confirmed sarcopenia in 64 patients, corresponding to a prevalence of 42.10% (95% IC: [34.4% - 50.10%]), including 21 women and 43 men. Thirty patients presented with severe sarcopenia. In bivariate analysis, the factors associated with sarcopenia were sex (p = 0.001) and BMI > 25 (p < 0.0001), BMI < 18.5 (p < 0.0001) (Table 2).

In multivariate analysis, factors independently associated with sarcopenia were male sex (OR = 5.98; 95% CI: 2.27 - 15.74), undernutrition (BMI < 18.5) (OR = 6.25; 95% CI: 2.08 - 18.74), and overweight (BMI > 25) (OR = 0.06; 95% CI: 0.01 - 0.49) (Table 3).

Table 1. Clinical parameters and biochemical indicators of patients with or without sarcopenia.

Variable		Mean or Percentages
Age (years)		47.88 ± 13.68
Sex	Women	75 (49.3%)
	Men	77 (50.7%)
Comorbidities		
Diabetes		5 (3.28%)
Hypertension		76 (50%)
25-OH Vitamin D (ng/mL)		40.01 ± 18.12
Serum calcium (mg/L)		88.11 ± 9.65
Serum phosphorus (mg/L)		33.82 ± 15.07
Ferritin (ng/mL)		829.73 ± 778.4
Intact PTH (pg/mL)		804.80 ± 720.08
Hemoglobin (g/dL)		8.84 ± 1.97
Dialysis duration (years)		7.59 ± 4.45
BMI (kg/m^2)		20.72 ± 4.91

Table 2. Results of bivariate analaysis.

Variables	With Sarcopenia n (%)	Without Sarcopenia n (%)	p-value
Age > 60 years	14	21	0.312
Female sex	21 (32.8%)	54 (61.4%)	0.001
Male sex	43 (67.2%)	34 (38.6%)	

Continued

BMI > 25 kg/m^2	2	30	<0.001
BMI < 18.5 kg/m^2	27	9	<0.001
Dialysis duration > 5 years	43	48 (54.9%)	0.095
Hemoglobin < 10 g/dL	34 (61.8%)	59 (72.0%)	0.213
Ferritin > 700 ng/mL	23 (41.8%)	27 (32.9%)	0.289
PTHi > 650 pg/mL	20 (36.4%)	37 (45.1%)	0.308
Vitamin D < 30 ng/mL	17 (30.9%)	21 (25.6%)	0.497
Phosphate < 25 mg/L	12 (21.8%)	22 (26.8%)	0.506
Serum calcium < 80 mg/L	7 (12.7%)	12 (14.6%)	0.752

PTH: Parathyroid hormone; BMI: Body mass index.

Table 3. Factors associated with sarcopenia (multivariable analysis).

Variable	aOR	95% CI
Male sex	5.98	2.27 - 15.74
BMI < 18.5	6.25	2.08 - 18.74
BMI > 25	0.06	0.01 - 0.49
Dialysis duration > 5 years	1.82	0.72 - 4.58

BMI: Body mass index.

4. Discussion

In our study conducted among patients undergoing chronic hemodialysis, the prevalence of sarcopenia was 42% according to the EWGSOP2 criteria. This prevalence lies at the upper end of the range reported in the international literature, where values generally vary between 20% and 60%, depending on the diagnostic criteria and assessment methods used [7]. African studies on sarcopenia in hemodialysis patients remain scarce. The only study that formally assessed sarcopenia in an African center, conducted by Crystal *et al.* (2024) in sub-Saharan Africa, reported a prevalence of only 4.1%, which is markedly lower than our findings [8]. In Asia, several studies have reported prevalences ranging from 28% to 60%, particularly when sarcopenia is diagnosed using the EWGSOP2 criteria or those of the Asian Working Group for Sarcopenia (AWGS), with the inclusion of muscle strength assessment [9]-[11]. In Europe and North America, prevalences generally range between 22% and 50%, with higher values observed in older populations, patients with diabetes, or those with longer dialysis vintage. One of the major factors explaining the wide variability in sarcopenia prevalence across studies is the heterogeneity of diagnostic definitions applied. Some studies use the EWGSOP2 criteria, others rely on the AWGS criteria, while others still use older or non-standardized definitions [7] [12] [13]. Beyond the definition itself, the method used to assess muscle mass or muscle function plays a decisive role.

Techniques such as dual-energy X-ray absorptiometry (DEXA), imaging modalities (MRI/CT), bioelectrical impedance analysis, or the use of handgrip strength and functional performance tests may yield substantially different results depending on hydration status, nutritional status, inflammatory state, and the timing of assessment relative to the dialysis session (pre- or post-dialysis) [7] [13]. In hemodialysis patients, inter- and intra-dialytic fluid shifts can markedly influence the estimation of muscle mass (lean mass, fat-free mass) when using bioelectrical impedance analysis or DEXA. These fluctuations may lead to an underestimation of muscle mass, thereby biasing the estimation of sarcopenia prevalence. In our study, measurements were performed under stabilized conditions (post-dialysis), which may partly explain the relatively high prevalence of 42%. Conversely, studies using less sensitive methods or non-standardized measurement conditions may underestimate sarcopenia, thus reporting lower prevalence rates [14]. Other factors may also account for these variations in prevalence. When the study population is globally older, a higher prevalence of sarcopenia is expected. Several studies have identified dialysis vintage as an independent risk factor [10] [15]; the longer a patient has been on dialysis, the more dialysis-related factors (chronic inflammation, protein catabolism, comorbidities, etc.) accumulate and promote muscle loss. In addition, African populations and those from low-resource settings are underrepresented in the literature, which limits the generalizability of published results. These biases may lead to either underestimation or overestimation of sarcopenia prevalence depending on the context. In multivariate analysis, factors independently associated with sarcopenia were male sex (OR = 5.98; 95% CI: 2.27 - 15.74), undernutrition (BMI < 18.5) (OR = 6.25; 95% CI: 2.08 - 18.74), and overweight (BMI > 25) (OR = 0.06; 95% CI: 0.01 - 0.49). We found that men were at higher risk of sarcopenia in our cohort. This finding is consistent with several published data. In a recent large review, male sex frequently emerged as a risk factor for sarcopenia in dialysis patients [7] [10] [16]. Several pathophysiological hypotheses may explain this association: Hormonal differences men partly rely on anabolic hormones, particularly testosterone, to maintain muscle mass. In the context of end-stage kidney disease and hemodialysis, hormonal decline—especially uremic hypogonadism—is common and may promote muscle catabolism; Greater baseline muscle mass in men inflammatory and metabolic catabolism may result in a more pronounced or more rapid loss of muscle mass and function in men compared with women; Therefore, male sex should be considered a risk marker in screening programs, as it may help identify a vulnerable population requiring targeted interventions; BMI < 18.5 kg/m^2 (undernutrition) low BMI was a significant risk factor in our study. This association is well documented in the literature. Several studies have demonstrated a link between malnutrition, the malnutrition-inflammation complex, and sarcopenia in dialysis patients [17]-[19]. A study using a "sarcopenia index" derived from nutritional parameters showed that protein-energy wasting is a strong predictor of muscle loss and muscle weakness in older patients on hemodialysis [20] [21]. Several mechanisms may explain this relationship: insufficient or inadequate protein intake in the context of chronic kidney disease and dialysis, due to amino acid losses, albumin loss, and poor nutritional intake [22] [23]; negative nitrogen balance, reduced protein synthesis, and increased muscle catabolism, exacerbated by chronic inflammation, metabolic acidosis, and dialysis-related losses [7] [10].

A BMI > 25 kg/m^2 may appear protective against sarcopenia in hemodialysis patients, as it often reflects greater energy reserves and a lower risk of undernutrition. However, BMI should be interpreted with caution, as it does not distinguish between fat mass and muscle mass [16]. Thus, a BMI > 25 may mask overweight or sarcopenic obesity (excess fat with reduced muscle mass), highlighting the need for a structured assessment. In accordance with the EWGSOP2 consensus, interpretation should integrate muscle strength, muscle quantity/quality, and physical performance, beyond BMI alone [5].

5. Conclusion

Sarcopenia is common among hemodialysis patients in Dakar. Male sex, and undernutrition were identified as significant risk factors. A prospective cohort would help assess temporal and prognostic relationships, while the current cross-sectional design already estimates prevalence. This study has several limitations. First, its cross-sectional design precludes the establishment of causal relationships between the identified associated factors and the development of sarcopenia. Second, a potential selection bias should be acknowledged, as patients unable to stand for bioelectrical impedance analysis, those with cardiac pacemakers, or those unable to complete the questionnaire were excluded. This may have led to an underestimation of the true prevalence of sarcopenia by systematically excluding more frail individuals. Finally, several potential confounding factors were not comprehensively assessed, including physical activity level, actual nutritional intake, inflammatory markers such as C-reactive protein, hormonal status (e.g., testosterone), and dialysis adequacy (Kt/V), which may have influenced the observed associations.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Statement of Ethics

The authors declare that the work described was carried out in accordance with the World Medical Association's Code of Ethics (Declaration of Helsinki) applicable to studies involving human subjects. The study protocol was approved by the local Ethics Committee under approval number CEH-DJ/2025/021.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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