Functional evaluation of patients undergoing hemodialysis with chronic kidney disease

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Objective

The chronic kidney disease (CKD) is characterized by the loss of the kidney's ability to eliminate toxic substances, concentrate urine and conserve electrolytes, with subsequent alteration of the remaining kidney function.

The severe loss of kidney function is a first-order threat to life and requires the removal of toxic waste that cannot be debugged with sufficient effectiveness for other organ systems, as well as the restoration of an adequate volume and composition of body fluids - dialysis. If the loss of renal function is irreversible patients have two options: kidney transplant or chronic dialysis.

Since 1977, with the pioneering study by Jette et al., it is well documented that patients with CKD on hemodialysis are limited in their overall physical capacity between 60 and 70% of that expected for their age, compared with healthy patients (Johansen, 2000) and most CKD patients are sedentary (Painter et al., 2000, Johansen et al., 2000). In Fig.1 we can observe a diagram of potential adverse effects of sedentary behavior and chronic kidney disease and potential beneficial effects of exercise interventions. With this study, our main objective is to evaluate the functional status of hemodialysis patients with CKD.

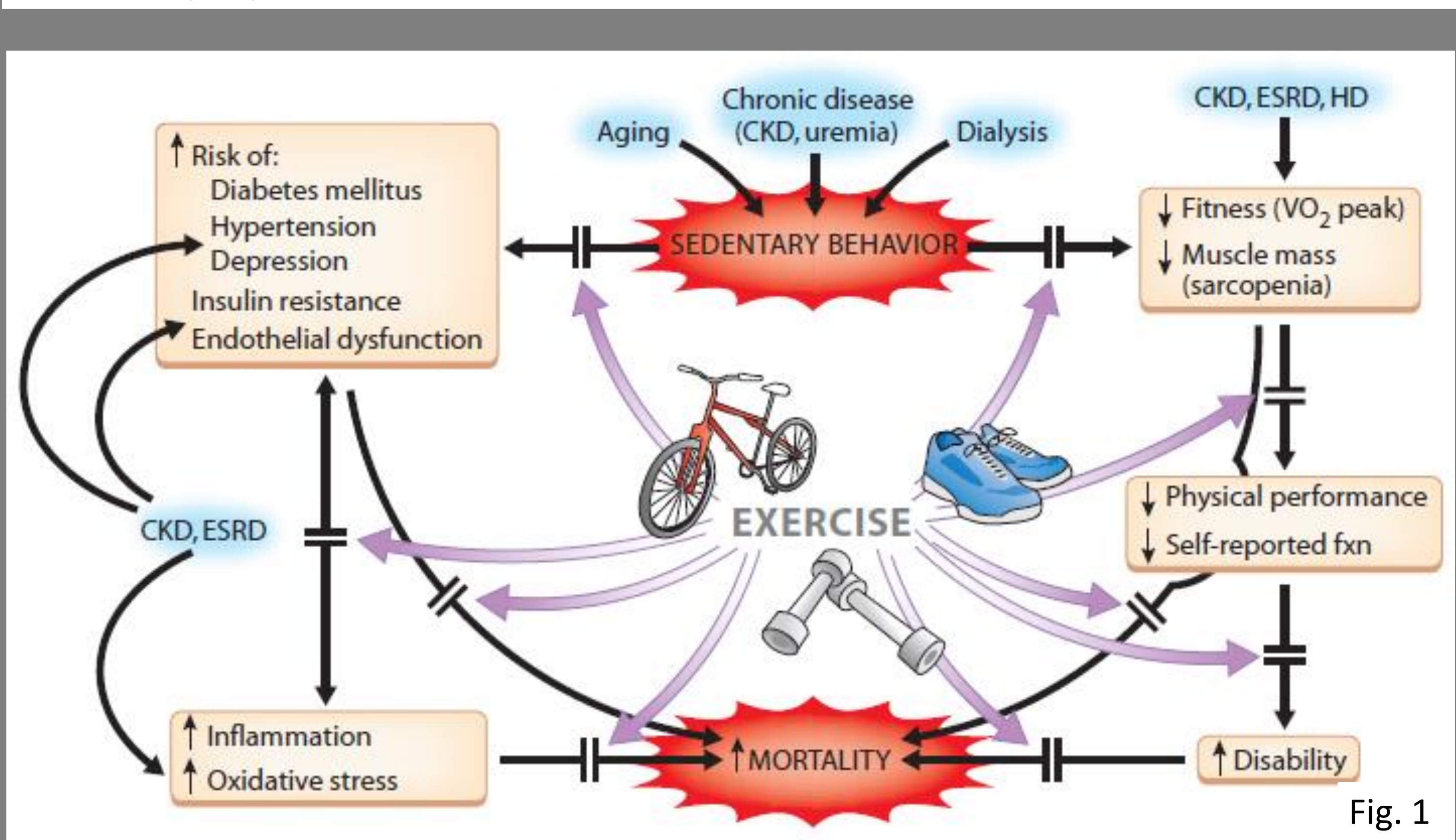

Fig. 1

Johansen KL. Exercise in the End-Stage Renal Disease Population. *J Am Soc Nephrol 2007 18:1845-1854*

Fig. 2

Fig. 3

Fig. 4

Material/Methods

The study was carried out by the NorDial Clinic (Mirandela city – Portugal) in a total population of 123 patients. We met the exclusion criteria defined by the American College of Sports Medicine.

Tests: anthropometric measurements, sit-to-stand (Fig. 2), up and go (Fig. 3), handgrip strength (Fig.4) and blood tests.

Material: Tefal scale accurate to ±100g, metric stadiometer (Detecto D52, USA), chair of 46cm, 8 memory stopwatch with precision 1/100 seconds (Bravo, Spain), cone with 40cm, manual hydraulic dynamometer Jamar®.

Results

60.5% of the patients of our study were men. This data is extremely variable in publications on hemodialysis. The average age of our participants is 63.46 years (women) and 61.16 years (men). But more important than biological age is the time on hemodialysis, since we know that the mortality of these patients increases in proportion to years of treatment. The men in our sample were on hemodialysis for 4.42 years and women for 6.17.

In the sit-to stand 60s test both men and women were able to reach an average of more than 30 repetitions (35.76±9.66 and 32.26±8.46 respectively). These values are higher when compared with other studies (McIntyre et al. 2006).

It is widely reported that patients undergoing hemodialysis have marked skeletal muscle dysfunction and that this dysfunction is also observed in handgrip strength. The values found in this study (175.91±51.35N for women and 321.1±84.1 for men, both for right hand) agree with the findings in the scientific literature. Comparing men and women, we observe lower values of strength in women as showed in other studies, which is perfectly described by the metabolic and structural differences. This is an important result due to the relationship between handgrip strength and quality of life (Hsieh et al., 2006).

The up-and-go test is a classic test to assess the mobility and walking capacity and is strongly related to lower limb strength and balance. In our study the results of this test were 7.6±3.05s and 9.37±3.78, for men and women respectively – results slightly higher than others published in other investigations like in Jamal et al. (2006).

As it is well known, the internal milieu of hemodialysis patients suffer numerous homeostatic changes derived from many factors, making it difficult to interpret analytical results, comparing men and women. Anyway, we found no baseline differences in the data published by other researchers relating to hemoglobin and hematocrit, since there is a consensus on the minimum tolerable to keep these patients through the dosage of erythropoietin (Table 1).

Table 1 - Analytic results	Women		Men
N	32		49
Hemoglobin (g/dL)	12,27±1,09		12,6±1,01
Hematocrit (%)	36,51±3,68		37,32±3,19
Urea before hemodialysis (mg/dL)	147,45±36,53	*	157,4±52,55
Urea after hemodialysis (mg/dL)	29,38±11,73	*	38,73±16,16
Creatinine (mg/dL)	7,72±2,36	*	9,64±2,44
Calcium (mg/dL)	9,01±0,63		9,14±0,57
Phosphorus (mg/dL)	4,83±1,12		4,52±1,27
PTH (ng/dL)	297,86±293,84		319,27±246,41
Ferritin (ng/dL)	446,78±189,08		388,19±189,37
EPO (μg)	27,33±23,56		24,32±27,47
Glucose (mg/dL)	100,93±41,07		112,31±57,7
Albumin (g/dL)	3,77±0,28		3,87±0,28
Cholesterol (mg/dL)	163,17±42,61	*	138,98±33,1
Triglycerides (mg/dL)	173,31±128,04		193,13±106,11
HDL (mg/dL)	52,17±12,92	*	42,66±11,35
LDL (mg/dL)	76,28±31,06	*	58,5±23,93
Lipoproteins (mg/dL)	55,28±78,49		38,83±47,62
Kt/v	2,97±0,25	*	1,79±0,33
Kt	54,92±9,28	*	61,9±9,66

* statistically significance at p<0,05

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Conclusion

a)The anthropometrics results of our patients are similar to other publications.
b)The overall functional capacity of our patients is lower than healthy population.
c)The overall functional capacity of our patients is higher than shown by other studies.