Correlation Between Karnofsky Performance Status Scale and Short-Form Health Survey in Patients on Maintenance Hemodialysis

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Background: Assessment of quality of life is vital in monitoring response to various treatment measures. Various instruments, which include both generic and disease-specific instruments, are used in the assessment of health-related quality of life (HRQOL). In this study, we compare two commonly used generic instruments.

Objectives: The objective of this study was to compare two generic instruments, the Karnofsky Performance Status Scale and the SF-36 Health Survey in hemodialysis (HD) patients. The study also aims to find out the association (if any) between HRQOL scores using these two scales and various clinical and biochemical parameters.

Materials and Methods: Sixty-two maintenance HD patients were recruited after informed consents were obtained. Detailed sociodemographic data was obtained. They were assessed during their regular HD sessions. Serum chemistry (which included serum urea, creatinine, Na^+, K^+, HCO_3^-, Ca^{2+}, Po_4^{2-}), albumin, globulin, total protein and hemoglobin (g/dl) were assessed in all the patients. Adequacy of HD was assessed using second-generation Daugirdas formula. HRQOL was assessed using the Karnofsky and SF-36 instruments and the scores collated and compared. Data was analyzed using SPSS version 10.

Results: Fifty-five patients completed the study (27 males and 28 females, mean age 40.76 ± 11.05 years and age range of 20–65 years). There was a significant positive correlation between Karnofsky scores and all eight SF-36 domains, but only physical functioning, social functioning and role limitation due to emotional problems maintained the significance on multiple regression analysis. The serum creatinine and hemoglobin positively correlated with physical function, bodily pain, social functioning and Karnofsky scores. Age of the patients correlated negatively with two SF-36 dimensions (physical functioning and role limitation due to physical fitness) and Karnofsky scores.

Conclusion: This study revealed a good correlation between Karnofsky performance status scale and the short-form (SF-36) health survey in this Egyptian population. Age, serum creatinine and hemoglobin significantly influence quality of life in this HD patient population.

Key words: HRQOL ■ Karnofsky ■ SF-36 ■ correlation ■ hemodialysis

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INTRODUCTION

Health-related quality of life (HRQOL) is often defined as "the value assigned to duration of life as modified by impairments, functional states, perceptions and social opportunities that are affected by disease, injury, treatment or policy."[1] Its assessment has become a vital tool not only in the monitoring of treatment outcomes in patients on various modalities of renal replacement therapy but also because it has been established to significantly influence morbidity and mortality.[2-4] The assessment of HRQOL is important, as it determines how closely the treatment modality achieves the fundamental principles of prolonging life, relieving distress, restoring function and preventing disability, consequently leading to a more productive and effective life. This is pertinent, as the World Health Organization definition of health brings to limelight the need for holistic approach to treatment.

Both generic and disease-specific instruments have been used in the assessment of HRQOL in chronic renal failure patients on various treatment modalities, each with its specific advantages and disadvantages but with generally good correlation.[5] In a recent Turkish study that utilized the Nottingham Health Profile (NHP) and Kidney Disease Questionnaire (KDQ) in the assessment of HRQOL in hemodialysis (HD) patients, it was found that the multiple-degree scoring in the KDQ was complex, though there was a good correlation between the dimensions of the NHP and KDQ.[6] In this study, we set out to compare two generic instruments—the Karnofsky Performance Status Scale (KPSS) and the Short-Form-36 Health Survey (SF-36)—in our HD population.

KPSS is a physician rating scale that guarantees an objective assessment of the patient's clinical state. It

was originally designed to assess quality of life in patients receiving cancer chemotherapy but has since been used in different disease states. It is perhaps the most commonly used HRQOL instrument.[7,8] The scale ranges from scores of 0 (at death) to 100, which implies full-functional capability to carry out normal daily activities without clinical evidence (symptoms or signs) of disease. A score below 70 represents a functional capacity that requires some assistance, but the patient could still care for most personal needs while that below 50 represent incapacitation that requires hospitalization or institutionalization.[7,8] Some of its demerits are the fact that it is independent of the patient's judgment and the fact that psychological state is downplayed. Hutchison et al.[9] have also raised questions on reproducibility of scores occasioned by poor interater reliability.

SF-36, on the other hand, looks at quality of life as a multidimensional model, assessing eight different perspectives of HRQOL—namely physical functioning; role limitations due to physical health problems; bodily pain; general health; vitality (energy/ fatigue); social functioning; role limitations due to emotional problems; and mental health, which implies psychological distress and psychological well-being.[10] It utilizes a 36-item questionnaire, which was constructed as an improvement on the older SF-8 and SF-20 scales.[8] This scale has internal consistency reliability of between 62% and 90% for the different domains in HD patients.[11] It also has test-retest reliability of between 60% and 81% for the different domains.[12]

Both generic scales have been used in the assessment of HRQOL in end-stage renal disease (ESRD) patients in different populations with generally good correlation but, to the best of our knowledge, there is no available documented report of use of SF-36 health survey in any Arab population; hence, the need for this study.

Aims and Objectives

In this study, we aim to compare two generic instruments—the KPSS and the SF-36—in our HD population. We also seek to find out the association (if any) between HRQOL scores using these two scales and various clinical and biochemical parameters.

PATIENTS AND METHODS

Patients

This comparative study was carried out between

Table 1. Karnofsky Performance Status Scale

100	Normal, no complaints, no evidence of disease		
90	Able to carry out normal activity, minor signs or symptoms of disease	A	Able to carry out normal physical activity at least part of the time, no special care needed
80	Normal activity with effort, some signs and symptoms of disease		
70	Cares for self, unable to carry out normal activity or to do work		
60	Requires occasional assistance from others but able to care for most needs		Unable to work, able to live at home, care for most personal needs. A varying degree of assistance is required.
50	Requires considerable assistance from others and frequent medical care	B	
40	Disabled, require special care and assistance		
30	Severely disabled, hospitalization indicated, death not imminent.		Unable to care for self, requires the equivalent of institutional or hospital care. Disease may be progressing rapidly.
20	Very sick, hospitalization necessary, active supportive treatment necessary.	C	
10	Moribund		
0	Dead		

July 2001 and February 2002. Sixty-two patients on regular maintenance HD in the King Fahd and Ghonaimy Dialysis Units of the Cairo University Hospital were recruited after an informed consent. Patients being prepared for renal transplantation were excluded as well as those that did not consent.

Hemodialysis Protocol

All HD patients had native arteriovenous fistula, usually in the left (nondominant) forearm, which served as the venous and return access. Dialysis machines used were Fresenius 4008B and Gambro AK90. Biocompatible polysulfone dialyzers made by Hydelena, Cairo, Egypt were used and, rarely, cuprophane dialyzers. The HD was bicarbonate-based with blood flow rates that ranged 300–400 mls per minute based on patient's tolerability. Ultrafiltration rates were individualized for the patients, as they was based on weight gain in the interdialytic period and the patient's known dry weight. The patients were on regular thrice- or twice-weekly HD sessions with the duration of sessions being four and six hours, respectively. They were assessed during their regular HD sessions, and detailed sociodemographic data was obtained from all the recruited patients. Their case records were also retrieved to validate the accuracy of the sociodemographic data. Detailed serum chemistry, which included serum urea, creatinine, Na^+, K^+, HCO_3^-, Ca^{2+} Po^{3-}, albumin, globulin and total protein, was assessed in all the patients. Hemoglobin (g/dl) was also determined for all the patients. The serum urea was determined just before and 30 minutes after completion of same HD session, the volume of ultrafiltration and post-dialysis or dry weight during these sessions were also recorded.

Adequacy of HD was assessed using second-generation Daugirdas formular,[13] i.e.,

$$Kt/v = [-\ln (R-0.03) + (4-3.5R) * (UF/W)]$$

Where R = predialysis blood urea nitrogen (BUN)/postdialysis BUN, W represents post dialysis weight or patient's dry weight in kilograms and UF, volume of ultrafiltration in Liters. This was determined for two sessions four weeks apart and the average computed.

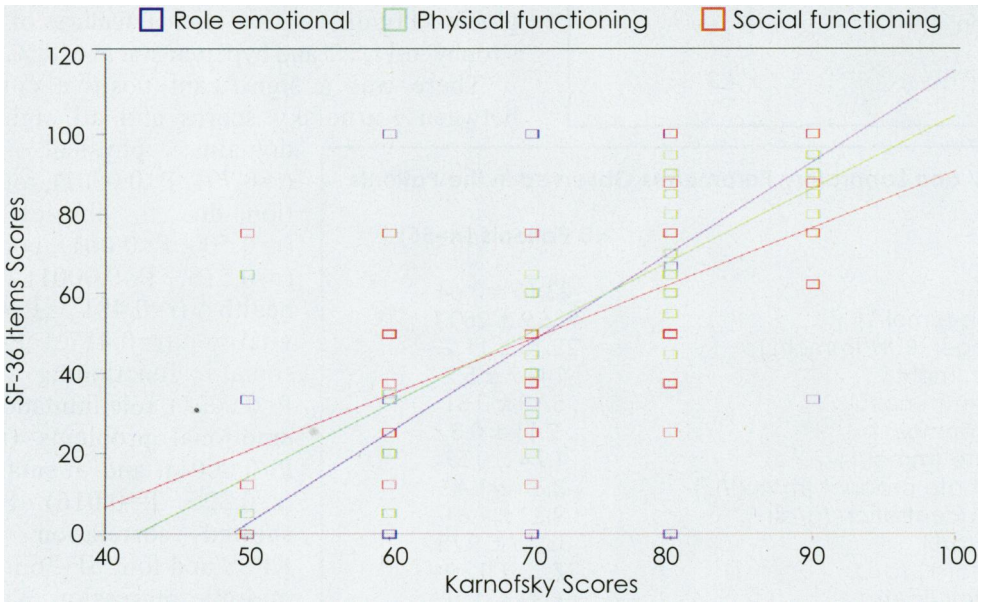
Health-Related Quality of Life Assessment

The KPSS and SF-36 were used to assess the quality of life in these patients. The detailed scoring using the Karnofsky scale is as shown in Table 1. The maximum score of 100 implies full-functional capability without symptoms and signs of ill health, while the minimum score of 0 is assigned to patients at death. Details of the characteristics of the patients with other scores are depicted in Table 1.[7]

SF-36, on the other hand, utilizes a 36-item questionnaire in assessing the eight different domains. The cumulative scores for the different domains were collated for all the patients and thereafter expressed as percentages on a transformed scale using the formula:

$$\text{Transformed Scale} = [(\text{Actual raw score} - \text{lowest possible score}) / \text{Possible raw score range}] \times 100$$ [10]

Figure 1. Correlation between Karnofsky Scores and Three SF-36 Items (Physical and Social Functioning Score)



The Arabic version of the SF-36 questionnaire was not available at the time of this study; hence, the English version was used. An interpreter fluent in both Arabic and English languages and also a member of the investigating team explained the 36-item SF-36 questionnaire to the patients who did not speak or understand English language and assisted the said patients in filling out the form. Those with a good understanding of the English language filled out their forms themselves. These were done usually during the dialysis sessions. The scores were independently collated and compared by the principal investigator and another member of the team. Where differences exist, the collation was rechecked and duly corrected. Scoring checks were done as recommended in the SF-36 interpretation manual.[10]

All patients had HRQOL assessment done twice—at least four weeks apart—and the average scores computed.

Table 2. Baseline Clinical and Sociodemographic Data of the Patients

Parameters	HD Patients (n=55)
Age (Years)	40.8 ± 11.0
Sex	
Male	27
Female	28
Marital Status	
Single	12
Married	40
Divorced	2
Widowed	1
Occupation	
Unemployed	40
Semiskilled	7
Senior Employee	8
Level of Education	
Nil	18
Primary	8
Preparatory/Secondary	14
Higher Education	15
Duration of HD (Years)	5.7 ± 4.3

Statistical Analysis

Statistical package for social sciences (SPSS) Version 10 by Microsoft Corporation USA was used for data analysis. Values were expressed as means ± standard deviation. Pearson bivariate correlation and multiple regression analysis were used as appropriate. Multiple regression analysis was used to determine the relative contributions of the various domains of SF-36 scores to the significance observed with KPSS on bivariate correlation. It was also used to test the relationship between biochemical parameters and various HRQOL scores and determine the relative contributions of the different domains where significance exists. The higher the beta values, the more the contributions of the items considered to the observed statistical significance. P values of less than 0.05 were taken as statistically significant.

RESULTS

Data analysis was based on the 55 patients (27 males and 28 females) that completed the study. The age range was 20–65 years (mean=40.76 ± 11.05 years). Table 2 shows the baseline data, while Table 3 shows the mean laboratory parameters and body mass index (BMI) of the studied population. Table 4 shows the means, minimum and maximum scores for the eight SF-36 domains and KPSS. Comorbid conditions found in these patients included anemia (hemoglobin <11g/dL) in 82%, clinical features of osteodystrophy in 11.2% and hypertension in 61.8%.

There was a significant positive correlation between Karnofsky scores and all eight SF-36 domains: physical function (r=0.791, P<0.0001), role limitation due to physical fitness (r=0.500, P<0.001), bodily pain (r=0.518, P<0.0001), general health (r=0.481, P<0.0001), vitality (r=0.417, P=0.002), social functioning (0.610, P<0.0001), role limitation due to emotional problems (r=0.551, P<0.0001) and mental health (r=0.325, P=0.016). Figure 1 showed correlation between KPSS and four SF-36 items. On multiple regression, Karnofsky scores correlated with only three

Table 3. Clinical and Laboratory Parameters Observed in the Patients

Parameters	HD Patients (n=55)
BMI(kg/m^2)	23.15 ± 3.64
Serum creatinine (µmol/L)	936.9 ± 250.1
Blood urea nitrogen BUN (mmol/L)	25.15 ± 11.29
Serum sodium (mmol/L)	142.7 ± 5.2
Serum potassium (mmol/L)	5.42 ± 0.81
Serum calcium (mmol/L)	2.11 ± 0.3
Serum phosphate (mmol/L)	1.74 ± 0.59
Calcium-phosphate product (mmol^2/L^2)	3.67 ± 1.40
Hemoglobin concentration (g/dl)	9.23 ± 1.61
Serum albumin (g/L)	33.46 ± 5.78
Serum protein (total) (g/L)	77.23 ± 12.91
Dialysis adequacy (kt/v)	1.39 ± 0.51

of the SF-36 items—namely, physical functioning, social functioning and role limitation due to emotional problems with beta values of 0.612, 0.225 and 0.207 and corresponding P-values of <0.0001, 0.012 and 0.027 respectively.

The mean hemoglobin was 9.23 ± 1g/l, which has significant positive correlation with physical function (r=0.431, P=0.004), bodily pain (r=0.361, P=0.016), general health (r=0.368, P=0.014), social functioning (0.310, P=0.041) and Karnofsky scores (r=0.622, P<0.0001) (Figure 2).

The mean serum creatinine was 936.9 ± 250.1μmol/l; there was a significant positive correlation between serum creatinine and physical function (r=0.436, P=0.002), bodily pain (r=0.379, P=0.009), vitality (r=0.364, P=0.013), social functioning (0.324, P=0.028), mental health (r=0.490, P=0.001) and Karnofsky scores (r=0.412, P=0.005). Serum creatinine also positively correlated with serum albumin (r=0.383, P=0.028) and hemoglobin (r=0.369, P=0.016) but negatively with weekly kt/v (r=-0.545, P<0.0001) (Figure 3).

Multiple regression analysis showed that Karnofsky scores only positively correlated with physical functioning, role limitation due to emotional problems and hemoglobin concentration with beta values of 0.577, 0.338 and 0.225, respectively, and corresponding P-values of <0.0001, <0.0001 and 0.009.

The mean BMI was 23.15 ± 3.65 kg/m^2, and it correlated negatively with bodily pain (r=-0.379, P=0.042) and Karnofsky scores (r=-0.423, P=0.022).

Age of the patients also correlated negatively with two SF-36 dimensions—namely, physical functioning (r=-0.468, P<0.0001) and role limitation due to physical fitness (r=-0.344, P=0.01). It also negatively correlates with Karnofsky scores (r=-0.373, P=0.005).

Mean (± SD) values for serum calcium, phosphate and calcium – phosphate product were 2.11 (±0.3) mmol/L, 1.74 (± 0.59) mmol/L and 3.67 (±1.4) mmol^2/L^2, respectively. 42.9% of the patients had hypocalcemia (serum calcium <2.1 mmol/L), while 40% had hyperphosphatemia (serum phosphate >1.77mmol/L), though only 20% had elevated calcium-phosphate product above 4.4 mmol^2/L^2. It negatively correlated with social functioning domain of SF-36 (r=-0.400, P=0.016). There was no correlation between it and Karnofsky scores.

DISCUSSION

Assessment of quality of life in chronic illnesses has become a vital tool not only in the monitoring of treatment outcomes but also because it has been established to significantly influence morbidity and mortality.[2-4] HRQOL assessment can be carried out using general or disease-specific instruments, which could be objective or subjective, or satisfaction- or function-based. It could be subdivided into measures of functional status, health status, and well-being and patient satisfaction. Each has its recognized merits and demerits, which include ease of interpretation, applicability and validation for different communities and comparability of results. A number of researchers utilize multiple instruments to be able to assess different subscales of HRQOL, as suggested by Gill and Feinstein.[14]

While KPSS is physician-dependent with little or no input from the patient, the SF-36 rating is dependent on the patient's assessment or perception of their health status, its high comprehensiveness and conciseness, and its validity have been variously demonstrated even in different languages.[15-18] This study, which the first documented reported use of the SF-36 health survey in the Egyptian population found a good correlation between the various dimensions of SF-36 and KPSS though physical functioning, social functioning and role limitation due to emotional problems, significantly influences the other SF-36 domains. This agrees with the findings of other researchers who found a generally good correlation

Table 4. HRQOL Scores in the Studied Patients

HRQOL Instrument	HRQOL Domains	HRQOL Scores (n=55) Minimum	Maximum	Mean	Standard Deviation
SF-36 Health Survey					
	Physical functioning	0	95	58.55	26.29
	Role limitations due to physical health problems	0	100	29.55	40
	Bodily pain	12	100	66.19	25.74
	General health	0	92	42.35	20.5
	Vitality (energy/fatigue)	0	90	47.45	21.06
	Social functioning	0	100	54.77	26.41
	Role limitations due to emotional problems	0	100	57.57	47.34
	Mental health	16	96	56.95	18.93
Karnofsky Performance Status Scale		50	90	74.81	11.45

between SF-36 and KPSS.[15] SF-36 scores were found to be poorer than that of the general U.S. population though better than that of U.S. patients with congestive heart failure, osteoarthritis or chronic obstructive pulmonary disease. This is particularly so in the physical fitness and emotional domains.[10]

This study found that serum creatinine positively correlated with various SF-36 dimensions and the KPSS rating. This is not surprising, as improvement in the dialysis dose is known to lead to improvement in appetite, increased muscle mass and vitality, which, in the long run, may lead to increase in serum creatinine.[19] Based on the aforementioned reasons, it is also not surprising that serum creatinine positively correlated with serum albumin and hemoglobin in this study. It is, however, startling that a negative association was found between serum creatinine and weekly kt/v; hence, there is a need for more studies

Figure 2. Correlation between Hemoglobin Concentration (g/dl) and Physical Functioning Score

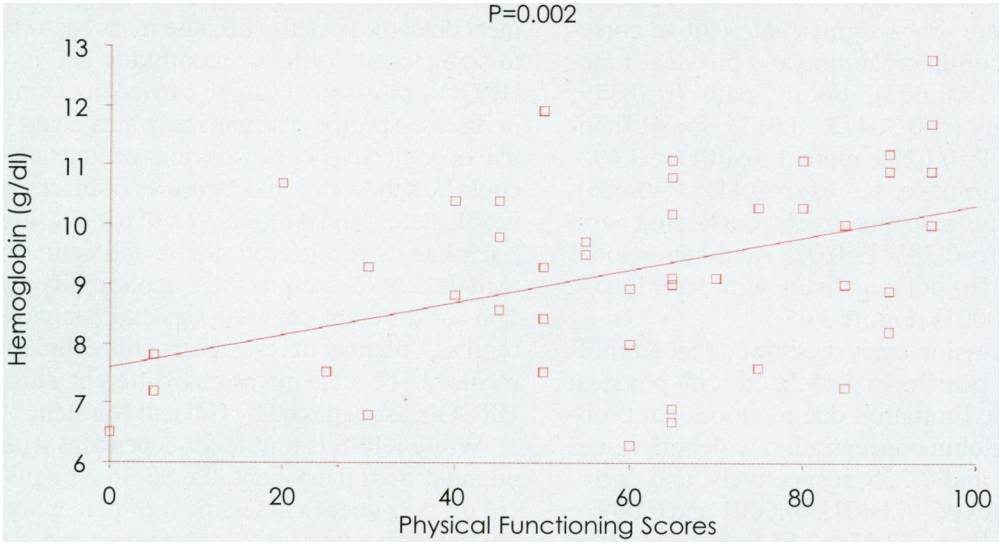
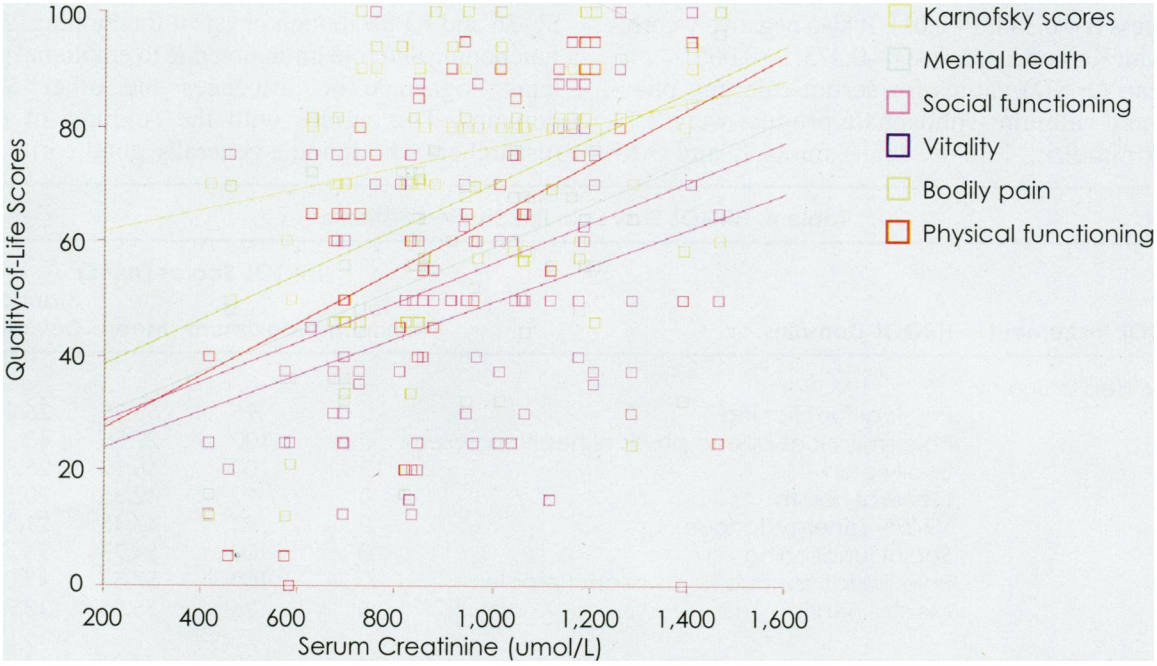


Figure 3. Correlation between Serum Creatinine and Various Quality-of-Life Scores



to further investigate this relationship.

Although malnutrition has been established to portend worsening morbidity and an increase in mortality in dialyzed patients,[19,20] we found a negative correlation between BMI and the KPSS rating and bodily pain component of the SF-36 health survey. The reasons for this finding are not clear, but other measures of nutritional status were not assessed; hence, no far-reaching deductions could be made.

There was preponderance of hypocalcemia and hyperphosphatemia in many (above 40%) of the studied patients. In addition, this study found a significant negative correlation between social functioning domain of SF-36 and calcium-phosphate products, which implies that features attributable to renal osteodystrophy could significantly impart on the quality of life in HD patients.

Studies have clearly shown that improvement in hematocrit leads to improvement in cardiovascular status, physical fitness and exercise tolerance. It has also been demonstrated to lead to improvement in overall quality of life and mortality.[21-23] It is, therefore, not surprising that in this study hemoglobin concentration positively correlated with KPSS and four SF-36 domains—namely, physical function, bodily pain, general health and social functioning. This is contrary to the findings of Mingardi et al.,[18] who found no association between HRQOL and hemoglobin.

The negative correlation between age and KPSS rating and two SF-36 items—namely, physical functioning and role limitation due to physical fitness—are in agreement with the findings of others.[24] In contrast to our finding, a Spanish study revealed that elderly patients showed higher standardized scores and lower loss of HRQOL than younger patients. This was statistically significant, although they compared subjects above and below 65 years, while the majority of our patients were below 65years.[25]

In this study, we found KPSS was relatively easy to apply, though it assesses only physical fitness; the SF-36 health survey, on the other hand, was more complex but assesses psychological and emotional domains in addition to assessment of physical fitness. The English version of the SF-36 health survey was used in this study with the aid of an interpreter in some cases, and this may have contributed to complexity and default rate observed. The Arabic version would be easier to apply and also save time for both patients and investigators. The Arabic version would be invaluable in assessing the different domains of HRQOL in all Arabic-speaking countries.

In conclusion, there is a good correlation between KPSS and the SF-36 in this Egyptian HD patient population. Age, serum creatinine and hemoglobin significantly influence quality of life in this population.

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