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Research Article

Attitudes and Barriers to Physical Activity in Hemodialysis Patients: Could Intradialytic Exercise Modify These Factors?

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Abstract

Introduction: This study pioneers in determining the impact of Intradialytic Exercise (IDE) on attitudes and barriers to Physical Activity (PA) in Hemodialysis (HD) patients in the United Arab Emirates, a non-western country with different cultural backgrounds.

Subjects and Methods: Forty-one adult HD patients from Al-Qassimi Hospital were recruited for a quasi-experimental intervention with pre-post evaluation. IDE patients trained for 45 minutes per HD session, 2-3 times per week, for 6 months on a static bicycle. Exercise intensity was assessed using the Borg Scale. Participants were educated on the importance of exercise.

Results: 30 patients completed the study. The percentage of patients exercising was higher post intervention, but dropped to baseline at the follow up period. At post intervention and follow-up, patient's knowledge about the benefits and safety of exercise increased, with some patients facing no barrier to PA at the end of the study (p=0.05). There was a significant increase in patients endorsing the "too many medical problems" barrier, and a significant decrease in patients endorsing the "can't afford to exercise" barrier. Nephrologists and nurses acknowledge the importance of exercise in HD patients, but the former do not prescribe it.

Conclusions: Aerobic IDE and knowledge empowerment programs could help HD patients increase their knowledge about exercise benefits and safety and shed some barriers to exercise, although patients appear to easily fall back into their normal habits. Even after an IDE program was adopted in the unit, the medical team is still concerned about the risks of exercise in HD patients.

Keywords: Attitude; Exercise; Hemodialysis; Nephrologists; Physical activity

Introduction

Physical Activity (PA) in Hemodialysis (HD) patients is low compared to healthy sedentary controls reporting to exercise a maximum of once a week [1]. The poor physical performance is associated with the muscle atrophy accompanying the inflammatory processes of Chronic Kidney Disease (CKD) [2]. To reverse muscle wasting, dietary intervention alone is not sufficient [3]. Thus emerges the need for Intradialytic Exercise (IDE) as a step to counteract sedentarism, which is associated with an increased risk of mortality among dialysis patients [4]. Unfortunately, HD patients face various barriers when it comes to the adoption of an

IDE program. A recent review has identified fatigue and lack of energy as the most common barriers to exercise in CKD patients, followed by the burden of comorbidities and lack of time or access to exercise [5]. However, it is not solely the patients' call, as lack of motivation is also a major factor for patients not to exercise [6]. Conversely, in HD patients not reporting barriers to exercise, the pro-active staff attitude proved to be effective in encouraging them to engage in PA programs [7]. To date, in general, the medical team is not advocating exercise for HD patients, the lack of time being a major contributor to this fact [7,8], in addition to the lack of confidence in the absence of guidelines [7].

In an initiative to overcome patients' barriers to exercise, Tentori, et al. (2010) highlighted that HD patients have higher chances of exercising in units offering exercise programs [9]. Particularly, HD patients, who had previously engaged in an exercise program, reported to be more positive towards exercise than their counterparts with no exercise exposure [10]. Furthermore, a study showed that home-based exercise program decreased the number of existing barriers towards exercise [11]. The current study is the first to assess the effects of a 6-months supervised IDE program on HD patients' barriers to PA, intradialytic or intradialytic exercise behavior, attitude, and knowledge in the United Arab Emirates (UAE). It also aimed to highlight the attitudes of the nephrologist and dialysis nurses towards integrating PA in HD patient's lifestyles. Most studies on this topic were conducted in western countries; this study unveiled the results from a Middle Eastern country, with different cultural background.

Material and Methods

Study Design and Participants

A 6-month, quasi-experimental intervention was conducted on all eligible and consenting patients from the HD unit in Al Qassimi Hospital, UAE, recruited via convenience sampling. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study does not contain any studies with animals performed by any of the authors. The study was approved by the Research Ethics Committees of the Ministry of Health and Prevention of the UAE (MOHP/DXB/SUBC/NO-5/2016) and Zayed University (ZU15_118_F), and registered in the ClinicalTrials.gov (ID: NCT03131804). Informed consent of all eligible patients was obtained before the initiation of the study. The study protocol and baseline results have been previously published [12].

The inclusion criteria were as follows: clinically stable, adult, on HD for ≥ 3 months, free of acute diseases and specific cardiovascular problems (cardiac pacemaker, uncontrolled blood pressure, symptomatic ischemic heart disease, arrhythmias, deep vein thrombosis, severe dyspnea), not practicing any exercise program at the time of the study, capable to communicate, fully aware of the study protocol, able to perform the cycle pedaler, and willing to provide a consent form. As for the exclusion criteria, these included patients not meeting the inclusion criteria, dialyzing from a femoral fistula, suffering from severe anemia (hemoglobin: < 9g/dl) [13] and/or uncontrolled diabetes.

Study Protocol

The study lasted 12 months, and was divided into 3 stages:

Baseline (T_0): The research team verified the planned intervention methods on 10 randomly chosen patients from the HD unit and offered a 1-month individualized patient education on the importance of exercise to their health. Patients were also introduced to the concept of IDE. Baseline assessment was conducted in the last 2 weeks of T_0.

Intervention (T_1): All consenting participants conducted the IDE in a supine position on a static pedaler "Pedal Exerciser KD" within the first 2 hours of dialysis for 45 minutes, 2-3 times per week, for 6 months. IDE sessions started with a 2-minute warm up, cycling at the lowest resistance of the pedaler [14]. Then, patients were advised to continue cycling at a moderate intensity level of exercise matching the level 12 on the Borg Rating of Perceived Exertion Scale [14,15]. Exercise intensity, duration, patient's complaints and Blood Pressure (BP) were recorded by the research team throughout each IDE session; in case of BP > 200/110 mmHg, exercise was not initiated or was stopped [16]. Patients were under the direct supervision of the medical team; in case of any discomfort, the intervention was immediately halted. In addition, patients received monthly one-to-one education on the benefits of exercise for HD patients focusing on its effect on dialysis efficiency and hyperphosphatemia management; moreover, ideas on safe workout modes and integration of exercise in their regular routine were provided. The education material was given in oral and written forms to patients (Appendix 1), and illustrated on a poster in the HD unit.

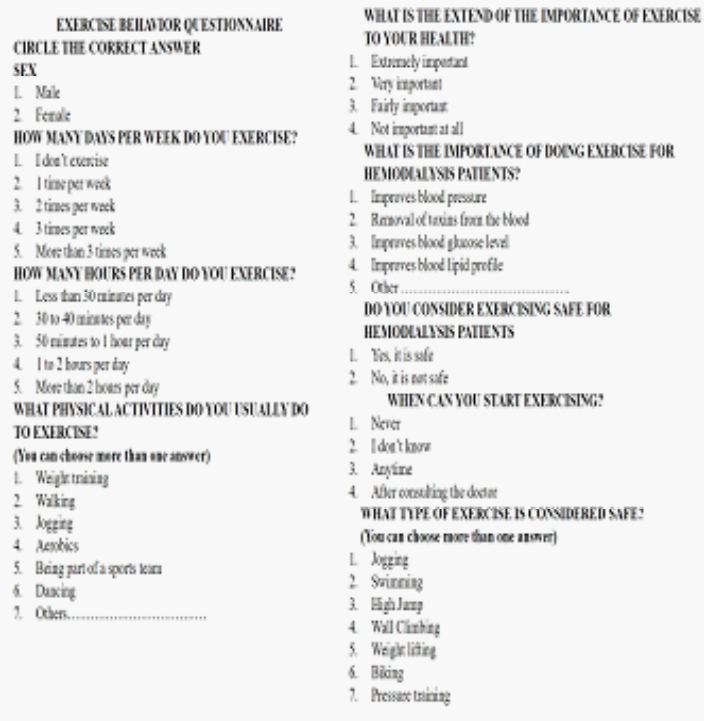
Appendix 1: Education Material.

Follow-up (T_2): After the IDE intervention, the research team refrained from seeing the patients for 3 months. Thereafter, all patients were assessed on the study outcome measures; the latter took 1 month.

Outcome Measures

Three questionnaires were used in this study:

- Exercise behavior, attitude and knowledge questionnaire developed by the authors of the study; based on the theory of planned behavior model [17]. It included 7 questions with multiple-choice answers (Appendix 2); for the questions about the correct knowledge on the safety and benefits of exercise, the patient who recorded one correct answer was considered to have the correct knowledge. The behavior questions assessed patients' level of PA, whether the activity is performed during dialysis (intradialytic) or outside the dialysis unit (intradialytic). Thus, it included the IDE related to our intervention.
- Patients' barriers to PA were assessed using a questionnaire adapted from Fiaccadori, et al. (2014) [8]. It included 24 questions assessing psychological, physical, and economical barriers, in addition to the lack of time factor and comorbidities. We removed the question on amputation, as this was an exclusion criterion in our study. Patients were considered as having a barrier if they experienced it "sometimes", "often" or "always"; if their reply was "never, patients were considered as not having this barrier. The final version of the questionnaire was shared and approved by Fiaccadori, et al. (2014) [8].
- Attitudes and practices of nephrologist and nurses towards PA conducted by HD patients were evaluated using a questionnaire developed by Fiaccadori, et al. (2014) [8]. It included 17 questions for the nephrologists and 13 questions for the nurses. Responders had to choose yes or no answers for each question. This questionnaire was administered at T_1.



EXERCISE BEHAVIOR QUESTIONNAIRE

CIRCLE THE CORRECT ANSWER

SEX

1. Male
2. Female

HOW MANY DAYS PER WEEK DO YOU EXERCISE?

1. I don't exercise
2. 1 time per week
3. 2 times per week
4. 3 times per week
5. More than 3 times per week

HOW MANY HOURS PER DAY DO YOU EXERCISE?

1. Less than 30 minutes per day
2. 30 to 40 minutes per day
3. 50 minutes to 1 hour per day
4. 1 to 2 hours per day
5. More than 2 hours per day

WHAT PHYSICAL ACTIVITIES DO YOU USUALLY DO TO EXERCISE?

(You can choose more than one answer)

1. Weight training
2. Walking
3. Jogging
4. Aerobics
5. Being part of a sports team
6. Dancing
7. Others.....

WHAT IS THE EXTEND OF THE IMPORTANCE OF EXERCISE TO YOUR HEALTH?

1. Extremely important
2. Very important
3. Fairly important
4. Not important at all

WHAT IS THE IMPORTANCE OF DOING EXERCISE FOR HEMODIALYSIS PATIENTS?

1. Improves blood pressure
2. Removal of toxins from the blood
3. Improves blood glucose level
4. Improves blood lipid profile
5. Other .....

DO YOU CONSIDER EXERCISING SAFE FOR HEMODIALYSIS PATIENTS

1. Yes, it is safe
2. No, it is not safe

WHEN CAN YOU START EXERCISING?

1. Never
2. I don't know
3. Anytime
4. After consulting the doctor

WHAT TYPE OF EXERCISE IS CONSIDERED SAFE?

(You can choose more than one answer)

1. Jogging
2. Swimming
3. High Jump
4. Wall Climbing
5. Weight lifting
6. Biking
7. Pressure training

Appendix 2: Exercise behavior, attitude and knowledge questionnaire.

Sample Size

GPower 3.1 software was used for sample size estimation; based on the change of serum phosphorus; since the latter was the primary outcome variable of the mother study. The needed sample size was n=34, assuming a two-sided type I error rate of 5%, a power of 80% and an effect size of d=|0.56|; this calculation was based on the findings of Makhlough, et al. (2012) [18]. Out of 57 eligible patients, 41 consented and were included in the analysis.

Data Collection

The research team conducted the questionnaires and collected demographics and blood tests results from the patients' medical files. All study outcome measures were collected at 3 time-points: T_0-T_1-T_2.

Statistical Analysis

For statistical analysis, we used the Statistical Package for the Social Sciences (SPSS), version 21 (IBM Corp., Armonk, NY, USA). Categorical and continuous data were summarized using descriptive statistics, and results were presented as frequencies

and percentages for categorical variables, and means and standard deviations for continuous ones. Cochran's Q Test was used to analyze the differences in barriers to PA between the 3 study timelines. Significance was accepted at $p \leq 0.05$.

Results

Characteristics of the patients

Forty-one patients were eligible and consented to enter the study, out of whom 30 patients completed the study. Reasons for patient's drop out were as follows: un satisfaction with the static pedaler, transfer to another dialysis unit, transplantation, and death. Half of the patients were males, relatively young (48.87 ± 11.29 years), and 73.4% of them were of Arab origin. Hypertension was prevalent in 93.3% of the sample, followed by diabetes (53.3%), and cardiovascular disease (13.3%). Full description of total sample characteristics at baseline is detailed in a previous publication [12].

Behavior, attitude and knowledge to exercise

The number of patients exercising either during dialysis or at home increased by 20% at T_1 and this change dropped back completely at T_2 (p=0.07). The percentage of patient exercising > 30 minutes remained almost the same at the 3 time-points of the study, with walking being the primary exercise at T_0 (100%) and T_2 (85%), yet cycling being dominant at T_1 (84.6%), which was the exercise adapted for the IDE intervention. All patients reporting to cycle at T_1 referred to the IDE intervention program. At T_2, only 25% of the patients continued the cycling exercise at home on a personal static pedaler. Throughout the study, the number of patients not intending to exercise remained constant (4 out of 30 patients), and the majority of the patients agreed on the importance of exercise for their health (p=0.22). The percentage of patients having the correct knowledge about the safety of exercise increased by almost 30% at T_1 and remained so at T_2 (p=0.26). Similarly, the patients having the correct knowledge about the benefits of exercise increased significantly by almost 40% at T_1 (96.7%) and this was maintained at T_2 (p=0.0). Data on exercise behavior, attitude and knowledge of our sample are detailed in (Table 1).

	T_0 n (%)	T_1 n (%)	T_2 n (%)	p value
Frequency of exercise per week				
Don't exercise	10 (33.3)	4 (13.3)	10 (33.3)	0.07
Exercise 1 or more times / week	20 (66.7)	26 (86.7)	20 (66.7)	
Attitude towards exercise importance on Health†(among full sample)				
Important	29 (96.7)	30 (100)	28 (93.3)	0.22
Not Important	1 (3.3)	0 (0.0)	2 (6.7)	
Knowledge about exercise safety for HD patients†				
Correct knowledge	16 (53.3)	24 (80)	25 (83.3)	0.26
False knowledge	14 (46.6)	6 (20)	5 (16.7)	
Knowledge about the benefits of exercise for HD patients†‡				
Correct knowledge	17 (56.7)	29 (96.7)	27 (90)	0.00*
No knowledge	13 (43.3)	1 (3.3)	3 (10)	
†Valid percentages are reported; ‡Percentages do not sum up due to multiple possible answers; *Based on Cochran's Q test, significance at $p \leq 0.05$				

Table 1: Exercise Behavior, Attitude & Knowledge Questionnaire**.**

Barriers to physical activity

There was a significant increase in patients reporting to have "too many medical problems" throughout the study phases. Also, there was a significant decrease in patients reporting that they "can't afford to exercise". There was no significant difference on the rest of the barriers assessed. Table 2 illustrates the perceived barriers to PA.

At T_0, all patients had at least 1 barrier to perform exercise. There was a 15% significant increase (p=0.05) in the number of patients who had 0 barrier to exercise at T_1 & T_2. Patients with 2 - 4 barriers to exercise decreased by 3% at T_1 and by almost 15% at T_2 (p=0.26). And those with 5 - 9 barriers to exercise remained constant (36.7%) throughout the study (p=1.00). Finally, at T_2, patients reporting ≥ 10 barriers doubled (26.7%) compared to T_0 and T_1 (p=0.20). The most frequently reported barrier at T_0 was "fatigue on dialysis days" (63.3%) followed by "Fear of getting hurt" (36.7%). At T_1, the most frequently reported barrier was "too many medical problems" (46.7%) followed by "fatigue on dialysis days" (43.3%). At the end of the study, at T_2, patients were left with 4 main barriers: "fatigue on dialysis days" (63.3%), "Too many medical problems (63.6%), "Pain on dialysis days" (53.3%), and "fatigue on non-dialysis days" (50%).

Barriers	T_0 n (%)	T_1 n (%)	T_2 n (%)	p value
Fatigue on dialysis days	19 (63.3)	13 (43.3)	19 (63.3)	0.07
Fatigue on non-dialysis days	10 (33.3)	10 (33.3)	15 (50)	0.1
Pain on dialysis days	8 (26.7)	12 (40)	16 (53.3)	0.06
Pain on non-dialysis days	6 (20)	9 (30)	14 (46.7)	0.06
Too many medical problems	9 (30)	14 (46.7)	19 (63.3)	0.02*
Fear of getting hurt	11 (36.7)	9 (30)	11 (36.7)	0.77
Lack of time on dialysis days	7 (23.3)	5 (16.7)	7 (23.3)	0.69
Lack of time on non-dialysis days	4 (13.3)	5 (16.7)	3 (10)	0.74
Lack of time because of too many medical appointments	4 (13.3)	4 (13.3)	4 (13.3)	1.00
Physician concern	4 (13.3)	1 (3.3)	2 (6.7)	0.24
Shortness of breath	9 (30)	9 (30)	9 (30)	1.00
Chest pain	8 (26.7)	6 (20)	6 (20)	0.69
Feelings of helplessness	7 (23.3)	6 (20)	6 (20)	0.92
Not wanting to be seen doing exercise	1 (3.3)	3 (10)	1 (3.3)	0.36
Ulcers on legs and feet	9 (30)	7 (23.3)	4 (13.3)	0.20
Feeling too old	2 (6.7)	6 (20)	5 (16.7)	0.19
No exercise partner	3 (10)	7 (23.3)	5 (16.7)	0.39
'I don't want to'	4 (13.3)	7 (23.3)	3 (10)	0.33
Sadness	7 (23.3)	8 (26.7)	7 (23.3)	0.93
Family concern	4 (13.3)	0	3 (10)	0.11
Can't afford to exercise	8 (26.7)	2 (6.7)	2 (6.7)	0.02*
Inability to travel	7 (23.3)	3 (10)	3 (10)	0.16
No place to exercise	3 (10)	3 (10)	3 (10)	1.00
Lack of safe place for exercise	4 (13.3)	8 (26.7)	6 (20)	0.42

Percentage of patients endorsing no barriers	0 (0.0)	4 (13.3)	5 (16.7)	0.05*
Percentage of patients endorsing 1 barrier	5 (16.7)	2 (6.6)	1 (3.3)	0.15
Percentage of patients endorsing 2-4 barriers	10 (33.3)	9 (30)	5 (16.7)	0.26
Percentage of patients endorsing 5-9 barriers	11 (36.7)	11 (36.7)	11 (36.7)	1.00
Percentage of patients endorsing ≥ 10 barriers	4 (13.3)	4 (13.3)	8 (26.7)	0.20
*Based on Cochran's Q test, significance at $p \leq 0.05$.				

Table 2: Perceived barriers to physical activity.

Attitudes of Nephrologist and Nurses Towards Exercise in Hemodialysis Patients

Four nephrologists filled the questionnaire. All of them acknowledged the importance of exercise for HD patients, were confident and had the time to discuss this issue during consultation. However, 3 out of 4 nephrologists were concerned about the risks of exercise for this population and thus do not prescribe it in their practice (Table 3). Nineteen nurses filled the questionnaire. All of them acknowledged the importance of exercise for HD patients. Most of the nurses (89%) were confident to discuss the topic with the patients, and reported often asking and counseling patients about PA. However, 84% felt that counseling is part of the physician's role (Table 3).

	Nephrologists	Dialysis Nurses
1. Physical inactivity is an important health risk in the general population	4/4	19/19
2. Increasing physical activity is beneficial for most people	4/4	19/19
3. Physical activity is beneficial for HD patients	4/4	19/19
4. I am concerned about the risks of exercise in HD patients	3/4	18/19
5. I believe that most HD patients would increase physical activity if advised to do so	3/4	18/19
6. I have time to talk to HD patients about physical activity	4/4	18/19
7. I think HD patients are interested in the topic of physical activity	3/4	18/19
8. I think exercise is important (or is as important as other medical issues)	4/4	19/19
9. I think it is the role of the physician to counsel HD patients about physical activity	4/4	16/19
10. I feel confident in my ability to discuss this topic with patients	4/4	17/19
11. I often ask HD patients about physical activity	2/4	17/19
12. I often counsel HD patients about physical activity	3/4	18/19
13. I often ask and counsel HD patients about physical activity	3/4	17/19
Addressed only to Nephrologists		
14. I often prescribe HD patients about physical activity	1/4	-
15. I often provide written material to HD patients about physical activity	0/4	-
16. I often refer HD patients to physiotherapist	2/4	-
17. I often provide equipment HD patients for exercise	0/4	-

Table 3: Attitudes of the medical team towards physical activity in HD patients.

Discussion

In the present study, we highlighted the change in patients' perceived barriers to PA following a 6-months IDE program in the UAE. The main finding was that "fatigue on dialysis days" remained the main barrier to PA; as for the chief success of the study, it was the ability of 6-month IDE to remove all barriers to PA from almost 15 % of the sample population (p=0.05). The study also unveiled the positive attitudes of the medical team towards exercise in HD patients in the UAE. In this study, 33.3% reported not to exercise before the intervention, which was quite similar to the 38.1% reported from 2 HD centers in Italy [19], but lower than the 43.9% reported internationally from the Dialysis Outcomes and Practice Patterns Study DOPPS9, and the >50% inactive patients in the study of Fiaccadori, et al. (2014) [8]. Elderly HD patients are more prone to physical frailty and thus decreased physical functioning [20]. Therefore, the higher percentage of exercising patients in our sample may be due to their younger age. Based on our results, a 6-months IDE program along with a monthly one to one patient education on exercise was sufficient to acquire and maintain the given knowledge at the end of the study (p=0.00). However, the intervention was not enough to sustain the exercise behavioral change. Our protocol did not assess patients' readiness to engage in a structured exercise program at baseline; thus each patient could have been in a different stage of readiness as suggested by the Transtheoretical Model (TTM) [21]. After 1 month of education, our patients were directly put into the "Action" phase; thus we assume that the duration given was not enough for all patients to sustain their behavior.

"Fatigue on dialysis days" continued to be the most identified barrier at the end of this study; a finding common in 5 other studies reporting on the prevalence of barriers to exercise in Italy, Canada and the USA [6,8,19,22,23]. Moreover, in Jordan, a country more comparable to UAE, "Tiredness" and "lower extremity fatigue" were noted as the focal barriers to exercise [24]. Thus, fatigue is a common barrier to PA identified cross culturally, regardless of patient's background, or social status, or even the weather condition he is living in. In the existing literature, few patients (3 - 6%) from different backgrounds endorsed only 1 barrier at the time of assessment [8,22]; this was the case in the UAE after the completion of the IDE program. At the end of our study, the main barriers remaining with the patients were related to their medical problems and the fatigue/pain due to the dialysis session, which are inevitable consequences of the normal progression of end stage renal disease [25,26]; the frequency of reporting some of these barriers increased during the intervention. In fact, with the acquired knowledge about the benefits and safety of exercise, patients were unconsciously looking for an excuse for their exercise behavior at T2; "Too many medical problems" seemed to be the most logical fact and thus barrier that we could not change. Also, we observed a significant decrease in the "can't afford to exercise" barrier; actually, the provided education introduced safe and inexpensive exercising modes for HD patients.

In the current study, 4 out of 5 nephrologists filled the questionnaire. Similarly, to the results from Delgado and Johansen (2010) study, all of the nephrologists agreed that exercise is beneficial but most would not prescribe it [27]. Also, all nephrologists agreed that exercise is as important as other medical issues versus 61.2% in Regolisti, et al. (2018) study [7] and 92.7% in Delgado and Johansen (2010) study [27]. Overall, 75% of the nephrologists were concerned about the risks of exercise compared to 40% reported by Delgado and Johansen (2010) [27]. The number of participants in Delgado and Johansen's study was much larger (n = 198) [27]; thus, our small sample size could have biased the results. Note that results from a small sample size study were the opposite of ours where 5/5 nephrologists did not consider exercise as important as other issue and were not confident to discuss the topic with patients, but 4/5 nephrologists prescribed it [8]. On the other hand, results from a study in the UK comparing barriers before and after experiencing an IDE program, revealed "staff workload" and "lack of time" to be the main barriers to exercise reported by both staff and patients at the 2 points in time [28]. In our program, the research team conducted the study and the hospital staff was not directly involved, thus we postulate that their answers were more theoretical and ideal.

One could question whether a lack of guidelines refrains the medical community from counseling the patients. In a study conducted by Delgado and Johansen (2010), nephrologists counseling behavior did not increase despite the Kidney Disease Outcomes Quality Initiative (KDOQI) cardiovascular guidelines recommendations for nephrologist to counsel their patients to increase PA [27]. In our study, 75% of the nurses and 95% of the nephrologists reported to be counseling their patients for exercise. Also, the lack of experience with equipment could provide a barrier to implementation of an IDE program. In Kontos, et al. (2007), nursing staff had trouble placing the heavy machinery to initiate the IDE, thus, they did not encourage their patients to exercise [23]. According to DOPPS, patients' exercising status is influenced by both patient's characteristics and the provision of appropriate exercise equipment at the HD unit [9]. Additionally, Johansen et al. (2003) reported low counseling levels in nephrologists facing lack of time, lack of confidence to counsel, lack of conviction that patients will respond and who believed that other medical problems were more important [29]. Staff reports from different facilities considered the lack of time as a constricting factor to promote PA [7,8,23]. Also, dialysis staff believed that only a program requiring minimal staff assistance could be feasible [6], although in our study, 95% of the nurses stated that they have time to talk about PA. Similar results were noted from the USA, where 76% of the

nurses have the time to discuss this topic in their daily routine [30]. In Al Qassimi Hospital, the nurse to patient ratio is 1:4 and nurses were compassionate and liked to entertain the patients. However, one may postulate that, in certain HD units, the lack of time could be the reason for not adopting IDE programs.

A limitation of our study is the absence of a comparative control group. We tried to attenuate this limitation by comparing the change in the same group at 3 points in time. Another limitation is the subjective tools used to assess the outcomes of the study. Perhaps using more tangible assessment methods for patient's exercise capacity and endurance or measuring patient's body composition would have allowed us to draw firmer conclusions. Finally, the young age of the enrolled patients is a limitation; the inclusion criteria for HD patients to enter an IDE program might have led to the exclusion of the elderly group in this sample population. In conclusion, aerobic IDE and one to one counseling may be associated with an increase in knowledge towards exercise in HD patients. Additionally, it may help some patients overcome their barriers to exercise. Although the nephrologists acknowledge the importance of exercise for HD patients, they are still refrained from prescribing it, as they are concerned about its risks. If adopted in HD treatment protocol, IDE could be part of the multidisciplinary approach to decrease the treatment burden of HD patients.

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