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Effects of listening to Holy Qur'an recitation and physical training on dialysis efficacy, functional capacity, and psychosocial outcomes in elderly patients undergoing haemodialysis

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ABSTRACT

The purpose of this study was to determine whether listening to Holy Qur'an recitation would augment the beneficial effects of physical exercise on physiological and psychological measures in elderly patients undergoing haemodialysis. Fifty-three male haemodialysis patients were randomly assigned to an intervention group (listening to Holy Qur'an recitation in combination with endurance–resistance training, $n = 28$) or a control group (endurance–resistance training only, $n = 25$). Functional capacity was assessed using the Timed Up and Go test (TUG) and the Six-Minute Walk Test (6MWT). Psychosocial outcomes were assessed using the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) and Hospital Anxiety and Depression Scale (HADS). Dialysis adequacy (Kt/V) was calculated for all patients. After intervention, a significant Group × Period interaction effect was observed for all measured parameters ($p < 0.05$), except for 6MWT performance ($p > 0.05$). All measured parameters were significantly improved over baseline in both groups, except for Kt/V in the control group ($p > 0.05$). Moreover, final measurements were significantly higher in the intervention group than in the control group for all measured parameters, except for 6MWT performance and the physical component summary of the SF-36 ($p > 0.05$). In conclusion, the present study showed that listening to a recitation of the Holy Qur'an in combination with interdialytic endurance–resistance training induced an improvement in physical condition and quality of life and a large reduction in anxiety among patients undergoing haemodialysis.

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1. Introduction

End-stage renal disease (ESRD) is a major public health problem throughout the world, which imposes a heavy economic burden on communities [1]. From a physiopathological point of view, the kidneys are not able to perform metabolic functions and cannot maintain fluid and electrolyte balance in the body, leading to uraemia. Patients with ESRD are characterized by low levels of physical activity associated with mobility limitations [2]. Furthermore, observational studies have revealed that physical inactivity is linked to increased early mortality in these patients [3]. Individuals with ESRD initially undergo medical treatment but often eventually require dialysis [4,5]. Haemodialysis (HD) is the most common renal replacement therapy for ESRD [6].

Likewise, several studies have been published suggesting the beneficial effect of different physical exercise programmes in patients receiving HD; most of these programmes have provided physiological, functional, and psychological benefits [7,8]. It has also been shown that musical interventions effectively reduce anxiety in HD patients [9,10]. Burrai et al. [11] demonstrated that 30 min of live saxophone music could be introduced to improve clinical and quality of life measures in patients undergoing HD. Moreover, Babamohamadi et al. [12] found that listening to the recitation of the Holy Qur'an induced a large reduction in anxiety levels among patients receiving HD, irrespective of age, gender, and family status. Qur'an-based intervention, given its easy availability and low cost, could be used along with other therapies (e.g. physical training) to achieve desired results, particularly in patients undergoing HD.

Thus, the main objective of this study was to determine whether listening to Holy Qur'an recitation would augment the beneficial effects of endurance–resistance exercise on physiological and psychological measures in elderly patients undergoing HD.

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2. Materials and methods

2.1. Participants

Fifty-three elderly male patients undergoing HD were recruited from the Department of Nephrology and Internal Medicine, Fattouma Bourguiba Hospital, Monastir, Tunisia. All subjects were Muslims. The volunteer patients were informed about the aims and the details of the study's methodology and were assured of the confidentiality of personal information. They gave their written informed consent and were free to withdraw from the study at any time. Inclusion criteria were: (1) absence of chronic respiratory and cardiac diseases; and (2) absence of neurological or musculoskeletal disorders. The participants were randomized into the intervention group (listening to Holy Qur'an recitation in combination with an endurance–resistance exercise programme, $n = 28$, age 65.4 ± 3.2 years, 75.7 ± 11.4 months on HD) or the control group (endurance–resistance training only, $n = 25$, age 64.5 ± 4.2 years, 76.7 ± 13.2 months on HD) using a computer randomization list. None of the subjects was engaged in any form of physical activity during the year before their enrolment in this study.

2.2. Study design

The study was approved by the local ethics committee. All patients were evaluated at baseline and after the 24-week intervention programme. On the first day, they completed the quality of life, anxiety, and depression questionnaires. The next day, patients were assessed using the Six-Minute Walk Test (6MWT) and the Timed Up and Go test (TUG). During the intervention period, endurance–resistance exercises were undertaken on days 1, 3, 5, and 7 of the week, whereas dialysis was carried out on days 2, 4, and 6. The duration of each HD session was 4 h.

2.3. Physiological data

2.3.1. Calculation of dialysis adequacy (Kt/V)

The dialysis adequacy was calculated for each patient according to the following formula:

$$Kt/V = (-1) \times \log (\text{Ratio} - (0.03) + (4 - (3.5 \times \text{Ratio}) \times (\text{Ultrafiltrate Volume/Weight})$$
$$\text{Ratio} = \text{Post-BUN/Pre-BUN}$$

where K is the dialyser clearance, t is dialysis time, V is the urea distribution volume, and BUN is blood urea nitrogen.

2.3.2. Functional mobility

2.3.2.1. Timed Up and Go test. This test was used to assess functional mobility [13,14]. A straight-backed chair with arms was placed 3 m from a marked line. The same chair was used at baseline and 24 weeks after implementation of the exercise programme. At the command 'Go', the patient rose from the chair, walked to the line, turned around, returned to the chair, and sat down. Time was recorded upon completion of the entire action.

2.3.2.2. Six-Minute Walk Test. The 6MWT was conducted according to international recommendations [15]. Subjects were instructed to walk at their own maximal pace along a 20 m long hospital corridor. They were asked to cover as much distance as they could within 6 min. Subjects were given feedback on time progression at each minute. They were allowed to stop and rest during the test, but were instructed to resume walking as soon as they felt able to do so. Before the test, patients rested in a chair, located near the starting position, for 10 min. At the end of the 6MWT, the distance covered (6MWD) was recorded.

2.4. Psychosocial outcomes

2.4.1. Quality of life

The Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) was used to evaluate self-reported health status [16]. This survey has 36 items compiled into eight scales: physical functioning (PF), role functioning/physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role functioning/emotional (RE), and mental health (MH). These scales range from 0 to 100; a higher score indicates a better quality of life (i.e. less pain or less limitation). Normalized scores representing overall physical functioning and mental functioning are calculated from the individual scales and are presented as the physical component summary (PCS) and the mental component summary (MCS). The PCS includes the dimensions of PF, RP, BP, GH, VT, and SF. The MCS is composed of the RE and MH, along with elements of the GH, VT, and SF scales [17]. The surveys were completed independently during dialysis by those patients capable of doing so. Patients unable to complete them independently because of vision or language problems were assisted by the study staff.

2.4.2. Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) is a self-assessment scale consisting of an anxiety symptoms subscale and a depressive symptoms subscale. HADS was developed to assess both anxiety and depression and has been validated to determine the risk in primary care [18]. All data were collected through face-to-face interviews by educated nurses in the Nephrology Department.

2.5. Intervention

2.5.1. Physical training

All patients received four interdialytic training sessions weekly for a period of 24 weeks (a total of 72 sessions). Resistance training consisted of dynamic strengthening exercises. Quadriceps muscles, pectoral muscles, triceps brachia muscles, biceps brachia muscles, and hamstrings were trained on a multigym. Patients started at 50% of the initial one-repetition maximum (1RM: the maximum load which can be moved only once over the full range of motion without compensatory movements) in the first week. Every month, the load was increased by 5% of the 1RM. Endurance training consisted of ergocycle exercise or treadmill walking sessions. A Borg score [19] of 5–6 for dyspnoea or fatigue was set as a target.

2.5.2. Listening to Holy Qur'an recitation

During HD sessions, patients in the intervention group listened to a recitation of the Holy Qur'an using an established protocol [20,21], while the control group received HD only. The complete Holy Qur'an was entirely recited by the reader Al-Dosari, who reads with a relaxing and calming voice.

Participants listened to the Holy Qur'an verses three times a week during 24 weeks, for 20 min each time (5 min before dialysis and continuing until 15 min after the start of dialysis). This method allows each patient to complete the Holy Qur'an at the end of the 24-week period. We note that this is the first study of its kind to use the complete Holy Qur'an in its intervention. The Holy Qur'an recitation was played through headphones on MP3 players and the volume was adjusted according to the patient's comfort.

2.6. Statistical analysis

Statistical analyses were carried out using Statistica Software 10.0 for Windows (StatSoft, Maisons-Alfort, France). Data are presented as mean and standard deviation (± SD). Assumptions of distributional normality were tested using the Shapiro–Wilk normality test. Relative changes (%) with corresponding 95% confidence intervals (CIs) were calculated for each measured variable. Data were analysed using a mixed-measures (Group × Period) analysis of variance (ANOVA) for repeated measures. If a significant effect was found, a post-hoc comparison using a Bonferroni test was followed. The effect size and corresponding 95% CI of difference/change in each measured variable were calculated [22]. Effect sizes were interpreted as trivial (0–0.19), small (0.20–0.49), medium (0.50–0.79), and large (0.80 and greater) [22]. Data were also assessed for clinical significance using an approach based on the magnitude of changes [23]. For within-/between-group comparisons, the likelihood that the true values of estimated difference/change were better/beneficial, similar, or detrimental/worse than the smallest worthwhile change was calculated for each measured variable [22]. Quantitative chances of better/beneficial or poorer/detrimental effect were assigned as almost certainly not (< 1%), very unlikely (1–5%), unlikely (5–25%), possible (25–75%), likely (75–95%), very likely (95–99%), and almost certainly (> 99%) [23]. The true difference/change was assessed as unclear when the chances of having better/beneficial or poorer/detrimental scores were both above 5% [23]. Statistical significance was set at $p < 0.05$.

3. Results

Mean values for all measured variables are presented in Table 1. A significant Group × Period interaction effect was observed for all measured parameters, except for 6MWD ($p > 0.05$). Post-hoc tests revealed that all measured parameters were significantly improved over baseline in both groups, except for *Kt/V* in the control group ($p > 0.05$). Moreover, final measurements were significantly higher in the intervention group than in the control group for all measured parameters, except for 6MWD and PCS ($p > 0.05$).

3.1. Within-group changes

Relative changes and qualitative outcomes resulting from the within-group analysis are illustrated in

Table 1. Baseline and final measurements for the two groups.

	Control group ($n = 25$)		Intervention group ($n = 28$)		Global effect		
Variable	Baseline	Final	Baseline	Final	Group	Period	Interaction
Anxiety	16.2 ± 1.5	13.2 ± 1.1*	15.8 ± 2.5	9.3 ± 2.1*†	#	#	#
Depression	15.1 ± 2.1	11.3 ± 2.0*	14.9 ± 2.1	9.4 ± 1.9*†	#	#	#
MCS	53.8 ± 10.1	60.7 ± 11.1*	53.2 ± 9.1	76.3 ± 10.2*†	#	#	#
PCS	52.5 ± 9.5	64.9 ± 11.7*	49.7 ± 7.9	70.0 ± 7.1*	#	#	#
Kt/V	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.2	1.3 ± 0.1*†	#	#	#
TUG (s)	14.1 ± 2.1	11.8 ± 1.8*	14.4 ± 2.3	9.9 ± 1.7*†	NS	#	#
6MWD (m)	390.6 ± 17.8	470.4 ± 28.0*	398.1 ± 15.1	468.9 ± 19.4*	NS	#	NS

Data are shown as mean ± SD.

MCS, Mental Component Summary of the 36-item Short-Form Health Survey (SF-36); PCS, Physical Component Summary of the SF-36; *Kt/V*, dialysis adequacy; TUG, Timed Up and Go test; 6MWD, Six-Minute Walk Test distance.

*Significantly different from corresponding baseline value ($p < 0.05$); †significantly different from control group ($p < 0.05$); #significant global effect ($p < 0.05$); NS, not significant ($p > 0.05$).

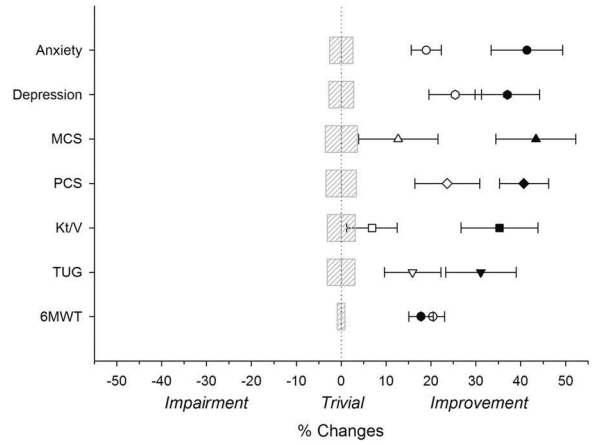

Figure 1. Within-group relative changes for anxiety, depression, mental component summary of the 36-item Short-Form Health Survey (SF-36) (MCS), physical component summary of the SF-36 (PCS), dialysis adequacy (*Kt/V*), Timed Up and Go test (TUG), and the Six-Minute Walk Test (6MWT) in the intervention group (black symbols) and the control group (empty symbols). Bars indicate uncertainty in the true mean changes with 95% confidence intervals. Trivial areas were calculated based on the smallest worthwhile change test. All parameters were almost certainly improved for both groups, expect for *Kt/V* in the control group (likely). Note that for clarity, all differences are presented as improvements for each group, so that negative and positive changes are displayed in the same direction.

Figure 1. For all measured parameters, the chances that the true changes were beneficial/unclear/detrimental were 100/0/0% (almost certainly) for both groups, except for MCS (98/2/0%, very likely) and *Kt/V* (90/10/0%, likely) in the control group.

3.2. Between-group differences

Results from the between-group analysis are presented in Table 2 and illustrated in Figure 2. Practically worthwhile differences between the control and intervention groups were evident, as supported by medium to large effect sizes and qualitative outcomes, suggesting very likely to almost certainly true changes, except for 6MWD (unclear).

Table 2. Changes observed for the experimental group compared to the control group.

Variable	Effect size (95% CI)	Rating	% Chances of better/ trivial/poorer effect
Anxiety	−1.60 (−2.23 to −0.97)	Large	100/0/0
Depression	−0.78 (−1.42 to −0.15)	Medium	96/3/0
MCS	1.66 (0.99 to 2.33)	Large	100/0/0
PCS	0.88 (0.37 to 1.39)	Large	99/1/0
Kt/V	1.77 (1.14 to 2.39)	Large	100/0/0
TUG (s)	−1.00 (−1.62 to −0.37)	Large	99/1/0
6MWD (m)	−0.52 (−1.37 to 0.32)	Medium	5/18/78

MCS, Mental Component Summary of the 36-item Short-Form Health Survey (SF-36); PCS, Physical Component Summary of the SF-36; *Kt/V*, dialysis adequacy; TUG, Timed Up and Go test; 6MWD, 6-Minute Walk Test distance; CI, confidence interval.

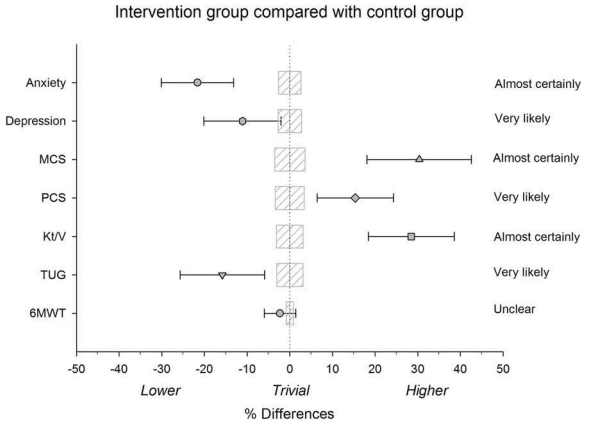

Figure 2. Relative differences between the intervention and the control group for anxiety, depression, mental component summary of the 36-item Short-Form Health Survey (SF-36) (MCS), physical component summary of the SF-36 (PCS), dialysis adequacy (*Kt/V*), Timed Up and Go test (TUG), and the Six-Minute Walk Test (6MWT). Bars indicate uncertainty in the true mean changes with 95% confidence intervals. Trivial areas were calculated based on the smallest worthwhile change test.

4. Discussion

The present study examined whether listening to Holy Qur'an recitation would augment the beneficial effects of endurance–resistance exercise on physiological, functional, and psychological parameters in a sample of elderly Muslim adults undergoing HD. The results show that listening to Holy Qur'an recitation during HD sessions can amplify the positive effects of endurance–resistance training in HD patients.

First, dialysis adequacy was significantly enhanced only in the intervention group after the 24-week intervention programme. Hence, implementation of combined training featuring both endurance and resistance exercises, along with Holy Qur'an recitation, resulted in a significant improvement in dialysis outcomes. This positive effect was not observed in previous investigations using only Holy Qur'an recitation. Hojjat et al. [24] explored the effect of music and sounds of the Holy Qur'an on dialysis adequacy among HD patients. They concluded that calculated adequacy shows a non-significant improvement in the Holy Qur'an recitation condition [24]. Our findings are in line with those of Rafiee [25], showing a positive effect of a 2-month stretching protocol on dialysis adequacy in HD patients at Shahid Hashemi Nejad hospital [25]. However, the increase in dialysis adequacy following a 2-month exercise programme was not statistically significant in the study by Fallahi et al. [26].

In the present study, the increase in *Kt/V* is clinically important since, based on United States Renal Data System (USRDS), for every 0.1 increase in *Kt/V* up to 1.2, the risk of early mortality decreases by 7% [27]. Similarly, the National Cooperative Dialysis study has

concluded that the greater the adequacy of dialysis, the lower the effects of uraemia on body different systems and patient mortality [28].

The physiological effects of the Holy Qur'an are achieved through two mechanisms. One is through the meaning of the Holy Qur'an for those who understand it, even if it is conveyed through a translation to those who do not understand the Arabic text. The other mechanism is through the sound of the Arabic Holy Qur'an words, even in those who do not understand their meaning, which could act as sound therapy [29].

Our study used the 6MWT, which is valid, easy to use, inexpensive, and representative of daily activities [30]. This test is widely used in patients with cardiac and lung diseases, but its application in HD patients in clinical research has been limited until now. The average distance achieved in the 6MWT in the pre-training phase was comparable to that achieved in other studies evaluating HD patients [31,32]. After endurance–resistance training, the distance covered in the 6MWT increased significantly, indicating considerable improvement in physical endurance. These findings were consistent with a previous study, which observed an improvement in physical performance as measured by the 6MWT after 20 weeks of training in patients undergoing dialysis [32].

Previous studies emphasize the role of physical activity in improving the quality of life in patients with various medical disorders such as stroke, Parkinson's disease, and chronic low back pain [33–35]. Our study also substantiates the profound effect of exercise on HD patients' quality of life. In addition, this is the first study showing the beneficial effect of listening to Holy Qur'an recitation on quality of life in HD patients. Further studies are required over a longer period to confirm this finding.

Despite advances in the treatment of patients with ESRD, many suffer from a high level of anxiety that can negatively affect their treatment [36]. In this study, we found that listening to the recitation of the Holy Qur'an had a positive effect on lowering the level of anxiety in patients undergoing HD. Similarly, several studies have reported beneficial effects of listening to the recitation of meaningful verses from the Holy Qur'an, including a reduction in anxiety [37–39].

Anxiety states are often the result of an imbalance in catecholamine secretion from the adrenal glands. Research has shown that music releases anti-anxiety substances in the body that may reduce anxiety levels [40]. The relaxing qualities of listening to Holy Qur'an recitation may be a result of the sound and lyrics of the Holy Qur'an verses in Arabic and its structure, in addition to the meaning of the words. The effect of listening to the intrinsic sounds that occur with recitation of the Holy Qur'an can be easily felt by Muslims, but not easily explained. The 'music' is hidden in the structure and lies in the combination of words within the sentences [41]. From a psychological point of view, the effect of listening to a relaxing voice can be explained by positive reinforcement and generation of a pleasant and enjoyable stimulus, just as it has been shown that music may protect the mind from pain [42].

Music therapy strengthens mental health by creating harmony and maintaining order and discipline, which is found in musical notes and also in words [43]. Studies have found the effects of music to be similar to a nursing intervention on patients' physical and mental conditions, which can reduce costs and maintain treatment effects [44,45]. To help explain the effects of Holy Qur'an recitation on the anxiety of patients undergoing dialysis, we refer to the positive effect that it has on preoperative anxiety, anxiety in intensive medical environments, anxiety before diagnostic and invasive medical therapies, vital signs during invasive procedures, vital signs in infants, respiration rates in those on mechanical ventilators, and duration of endotracheal tube intubation after major surgery [46–50]. Although it cannot be classified as music, the experience can, to a certain extent, be compared to the effect of sounds, like those generated by the reader Al-Dosari reciting the Holy Qur'an.

In the different parts of the Holy Qur'an, the relationship between the remembrance of Allah and reading the Holy Qur'an in a relaxed way is clearly mentioned and can reduce anxiety. 'We send down (stage by stage) in the Qur'an that which is a healing and a mercy to those who believe: to the unjust it causes nothing but loss after loss' (Al-Isra: 82); 'Those who believe, and whose hearts find satisfaction in the remembrance of Allah: for without doubt in the remembrance of Allah do hearts find satisfaction' (Al-Rad: 28) [51]. It seems that listening to the voice of Holy Qur'an diverts thoughts from anxiety, pain, and negative experiences to pleasant thoughts (remembrance of Allah). Therefore, it can help people to cope with emotional stress and decrease their anxiety [52].

Our study aimed to document the positive effect of listening to Holy Qur'an recitation on the outcomes of post-dialysis treatment. Further research could be conducted to investigate the possibility of obtaining similar effects in cohorts undergoing other types of medical intervention such as orthopaedic surgery.

5. Conclusion

The present study shows that listening to a recitation of the Holy Qur'an in combination with interdialytic endurance–resistance training induced improvements in the physical condition and quality of life, as well as

a large reduction in anxiety, among patients under dialysis treatment. This is considered as an easily available complementary therapy that is less expensive than many other treatments for anxiety, decreased physical performance, and quality of life. This therapeutic measure could be used alongside other therapies to achieve improved outcomes, particularly in patients undergoing HD.

Disclosure statement

No potential conflict of interest was reported by the authors.

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