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Intradialytic stretching exercise on muscle cramps, fatigue among patients undergoing haemodialysis

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Abstract:

Haemodialysis is a life-saving treatment that steps in when your kidneys can no longer properly filter your blood. It acts as a substitute by removing waste, extra fluid and excess minerals caused by kidney failure. A quasi-experimental study was conducted among 36 haemodialysis patients in Gujarat to assess the effect of intradialytic stretching exercises. The experimental group performed 20 minutes of stretching during dialysis for 20 days, while the control group received routine care. The intervention significantly reduced muscle cramps and fatigue. It also improved activities of daily living as measured by the Barthel Index. Thus, data shows that intradialytic stretching is a simple, safe and effective non-pharmacological nursing intervention.

Keywords: Intradialytic stretching exercise, muscle cramps, fatigue, activities of daily living, haemodialysis, chronic kidney disease (CKD), non-pharmacological nursing intervention

Background:

Chronic kidney disease is a progressive, irreversible condition that disrupts multiple organ systems and its prevalence rises steeply with advancing disease stage, with hormonal and metabolic dysfunction affecting the majority of patients in advanced stages [1]. When kidney function declines to end stage, renal replacement therapy becomes necessary and haemodialysis remains the most widely used modality worldwide. Although haemodialysis prolongs survival, the treatment itself imposes a substantial symptom burden that reduces comfort and quality of life throughout the illness trajectory [2]. Muscle cramps are among the most common and distressing intradialytic complications and are closely related to rapid fluid removal, high ultrafiltration rates, intradialytic hypotension and electrolyte shifts during the procedure [3, 4]. A low serum magnesium concentration and other metabolic disturbances further contribute to the pathophysiology of cramping in this population [5]. Cramps and other musculoskeletal symptoms are frequent in dialysis patients and are associated with longer dialysis duration and the presence of comorbidity [6]. Muscle cramps, fatigue and reduced physical function commonly cluster together in dialysis patients and this neuromuscular symptom cluster adversely affects treatment tolerance and health-related quality of life [7]. Fatigue is particularly pervasive and disabling; together with mobility limitation and pain it ranks among the most prevalent symptoms reported by patients with advanced kidney disease [8]. These physical burdens are compounded by psychological and social challenges, especially in patients dependent on long-term maintenance haemodialysis [9]. Declining physical function and its association with reduced independence and impaired functional status make preservation of activities of daily living an important therapeutic goal [10]. Pharmacological measures for cramps and related symptoms are often only partially effective and may carry adverse effects, so simple non-pharmacological approaches have gained attention [11]. Muscle-stretching exercise, which is inexpensive, requires no equipment and can be taught readily, has been shown to reduce the frequency and intensity of muscle cramps and may act by improving lower-limb circulation and neuromuscular relaxation [12]. Therefore, it is of interest to evaluate the effectiveness of intradialytic stretching exercise on muscle cramps, fatigue and

activities of daily living among patients undergoing haemodialysis in a selected hospital in Gujarat.

Methodology:

Research approach and design:

A quantitative research approach with a quasi-experimental two-group pre-test-post-test design was adopted to evaluate the effectiveness of intradialytic stretching exercise on muscle cramps, fatigue and activities of daily living among patients undergoing haemodialysis.

Setting and population:

The study was conducted in the haemodialysis unit of a selected hospital in Gujarat, India. The target population comprised patients with chronic renal failure undergoing maintenance haemodialysis who met the eligibility criteria.

Sample and sampling technique:

A total of 36 haemodialysis patients were selected using convenient sampling and divided into experimental and control groups of 18 each. The experimental group received 20 minutes of intradialytic stretching exercise for 20 days along with routine care, whereas the control group received routine care only. Muscle cramps, fatigue and ADL were assessed using the Cramp Assessment Scale, Fatigue Assessment Scale and Barthel Index. Due to attrition, 17 participants in the experimental group completed both assessments.

Data analysis:

Data were analysed using descriptive and inferential statistics. Frequency, percentage, mean and standard deviation were used to summarise the data. Paired 't' test was applied to compare pre-test and post-test scores, while the chi-square test assessed associations with demographic variables. Statistical significance was considered at $p \leq 0.05$.

Results:

Table 1 shows the frequency and percentage distribution of demographic variables in the two groups. In the experimental group most patients were in the 41–50-year age band (33.33%) and were male (66.67%), moderately active (55.56%) and vegetarian (55.56%); a majority used calcium supplements (77.78%) and underwent two dialysis sessions per week

(61.11%). The control group had a comparable profile, with the largest proportion aged 52–60 years (38.89%) and predominantly male (61.11%). The two groups were broadly comparable across the demographic variables. **Table 2** presents the comparison of pre-test and post-test scores in the two groups. In the experimental group, the mean muscle cramp score decreased from 32.72 to 15.96 (mean difference 16.76; computed $t = 4.423$), the mean fatigue score decreased from 27.36 to 14.32 (mean difference 13.05; computed $t = 4.15$) and the mean Barthel ADL score increased from 65.80 to 78.80 (mean difference 13.00; computed $t = 4.10$). All three changes exceeded the table value of

2.110 ($df = 17$) and were statistically significant at $p \leq 0.05$, indicating that hypothesis H1 was accepted for the experimental group. In the control group, the corresponding changes in muscle cramps, fatigue and ADL were small and none reached statistical significance, so H1 was rejected for the control group. **Figure 1** indicates that mean post-test scores for muscle cramps, fatigue and activities of daily living among patients undergoing haemodialysis in the experimental and control groups are improved as compared to pre-test score. In this post-test score is improved which shows that reduced fatigue, muscle cramps and improved activities of daily living.

Table 1: Frequency and percentage distribution of demographic variables of the experimental and control group subjects

Sl.	Demographic variable	f (Exp)	% (Exp)	f (Ctrl)	% (Ctrl)
1	Age (in years)				
	21–30	01	5.56	03	16.67
	31–40	03	16.67	01	5.56
	41–50	06	33.33	06	33.33
	52–60	04	22.22	07	38.89
	60 and above	04	22.22	01	5.56
2	Sex				
	Male	12	66.67	11	61.11
	Female	06	33.33	07	38.89
3	Lifestyle				
	Sedentary	05	27.78	06	33.33
	Moderately active	10	55.56	06	33.33
	Active	03	16.67	06	33.33
4	Diet				
	Vegetarian	10	55.56	11	61.11
	Non-vegetarian	08	44.44	07	38.89
5	Duration of renal failure				
	0–1 year	07	38.89	06	33.33
	1–4 years	05	27.78	08	44.44
	5–8 years	03	16.67	04	22.22
	9 years and above	03	16.67	00	0.00
6	Duration of hemodialysis				
	0–1 year	07	38.89	06	33.33
	1–2 years	05	27.78	06	33.33
	3–4 years	03	16.67	06	33.33
	5 years and above	03	16.67	00	0.00
7	Use of calcium supplements				
	Yes	14	77.78	08	44.44
	No	04	22.22	10	55.56
8	Presence of comorbid illness				
	Yes	10	55.56	10	55.56
	No	08	44.44	08	44.44
9	Dialysis sessions per week				
	1	01	5.56	00	0.00
	2	11	61.11	12	66.67
	3	06	33.33	06	33.33
10	Exercise performance at home				
	Regular	04	22.22	08	44.44
	Irregular	07	38.89	03	16.67
	Never	04	22.22	07	38.89
	Stopped due to illness	01	5.56	00	0.00
11	Family history of CKD				
	Yes	02	11.11	04	22.22
	No	16	88.89	14	77.78

Note: f = frequency; % = percentage. Percentages are rounded to two decimal places
N = 36 (Experimental Group n = 18, Control Group n = 18)

Table 2: Comparison of overall pre-test and post-test levels of muscle cramps, fatigue and activities of daily living in the experimental and control groups

Observation	Pre-test mean	Post-test mean	Mean difference	Computed t	Significance
Muscle cramps (Exp)	32.72	15.96	16.76	4.423	S
Fatigue (Exp)	27.36	14.32	13.05	4.150	S
ADL (Exp)	65.80	78.80	13.00	4.100	S
Muscle cramps (Ctrl)	31.20	31.28	0.08	0.560	NS
Fatigue (Ctrl)	27.40	28.16	0.76	1.540	NS

ADL (Ctrl)	67.60	67.00	0.60	0.610	NS
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Note: Exp = experimental group (n = 17); Ctrl = control group (n = 18); table value = 2.110 at df = 17; S = statistically significant, NS = not significant at $p \leq 0.05$

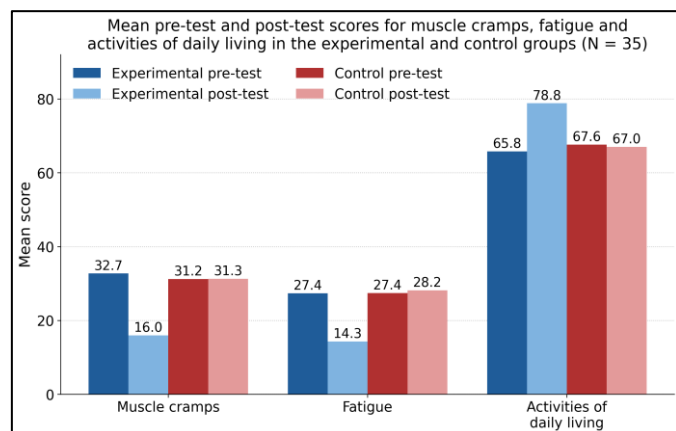


Figure 1: Mean pre-test and post-test scores for muscle cramps, fatigue and activities of daily living among patients undergoing haemodialysis in the experimental and control groups

Discussion:

The present study showed that intradialytic stretching exercise significantly reduced muscle cramps and fatigue and improved activities of daily living among patients undergoing haemodialysis, whereas no significant change occurred in the control group receiving routine care alone. These findings confirm that a simple, nurse-deliverable stretching protocol is an effective non-pharmacological approach for symptom management during dialysis. The results are directly consistent with Shehata *et al.* [13], who reported that a nurse-led intradialytic stretching protocol produced large reductions in cramp burden compared with usual care in maintenance haemodialysis patients. The benefit for activities of daily living aligns with Yogalakshmi *et al.* [14], who found in an Indian dialysis population that an integrated intradialytic nursing intervention significantly reduced fatigue and enhanced patients' ability to participate in daily activities. The marked reduction in fatigue and the gain in functional independence observed in the present study are in line with a broad body of intradialytic exercise research. Elhamrawy *et al.* [15] reported that intradialytic exercise significantly improved functional independence in activities of daily living and reduced fatigue and Feng *et al.* [16] showed that intradialytic elastic-band exercise significantly lowered fatigue scores while improving physical and cognitive function. Nakoui *et al.* [17] showed that structured intradialytic training significantly reduced fatigue relative to controls and da Silva Almeida *et al.* [18] found that both resistance and aerobic intradialytic exercise were feasible and improved physical performance, with aerobic training particularly effective for general fatigue. Improvements in quality of life and functional capacity with intradialytic exercise have been confirmed by Keles *et al.* [19], while neuromuscular electrical stimulation delivered during dialysis has been shown to enhance muscle oxygenation, aerobic capacity and fatigue tolerance in end-stage renal disease [20]. These single-studies

observations are reinforced at the level of pooled evidence: a systematic review and meta-analysis by Zou *et al.* [21] found that intradialytic exercise significantly reduced frailty and fatigue and increased grip strength and walking distance and a meta-analysis by Alves *et al.* [22] reported improvements in lower-limb muscle strength with intradialytic resistance exercise. A further meta-analysis by Traise *et al.* [23] showed that supervised intradialytic exercise significantly improved the physical and mental quality-of-life components in dialysis patients. Consistent with the present findings, Joseph *et al.* [24] observed modest improvements in quality of life and physical function with intradialytic resistance exercise in a quasi-experimental design similar to ours and a narrative review by Lee *et al.* [25] concluded that intradialytic exercise is a feasible and safe strategy that enhances physical function, cardiopulmonary capacity and health-related quality of life while counteracting the muscle loss and deconditioning associated with haemodialysis. The beneficial effects of stretching observed in the present study may be explained by improved lower-limb circulation, neuromuscular relaxation and reduced muscle excitability, which together lessen cramp frequency and perceived fatigue and thereby support better functional independence. A study conducted by Chandralekha CS & Prabha RMR indicates that Intradialytic stretching exercises proven to decrease fatigue at the level of significance ($p < 0.01$) The study also reveals that there is significant improvement in frequency and severity of muscle cramps after implementing intradialytic stretching exercises [26]. Alagarsamy *et al.* concluded that the intradialytic stretching exercises has significant effects in reduction of muscle cramps and pain in patients receiving haemodialysis and which can be used as a preventive therapy to reduce muscle cramps [27].

Conclusion:

Intradialytic stretching exercise administered during haemodialysis produced significant reductions in muscle cramps and fatigue and a significant improvement in activities of daily living, while no such changes occurred with routine care alone. Intradialytic stretching is a simple, safe, economical and non-invasive nursing intervention that can be integrated into routine dialysis care to relieve symptoms and enhance functional independence in patients undergoing haemodialysis.

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