

Table II - Summary of the characteristics of the articles analyzed

Author/Year	Country	Sample	Participants	Control	Intervention	Mensure	Results
Deley <i>et al.</i> 2008 [15]	EUA	44	Patients with stable chronic heart failure	Conventional aerobic training programmes.	5 weeks of exercise training with electrical myostimulation (EMS)	Functional capacity	Both training protocols induced significant improvements in the distance walked in 6 min (+ 13.8% in EMS and + 16.5% in control, $p < 0.001$).
Dobšák <i>et al.</i> [14]	Czech Republic.	30	Patients with stable chronic heart failure, NYHA class II-III	8 weeks of exercise bicycle training	8 weeks of home-based low-frequency electrical stimulation (LFES)	Functional capacity and quality of life	Distance walked in 6 minutes (LFES group: from 398 ± 105 m to 435 ± 112 m, $P < 0.05$; bicycle group: from 425 ± 118 m to 483 ± 120 m, $P < 0.03$)
Deley <i>et al.</i> 2005 [16]	France	24	Patients with stable CHF	Conventional aerobic training programmes.	EMS consisted of stimulating both quadriceps and calf muscles using two portative dual-channel stimulators	Functional capacity and muscle strength	Both training protocols have induced significant improvements in the distance covered in 6 min (+ 11.9%, $P < 0.01$. in EMS and + 15.3%, $P < 0.001$ in conventional exercise. The strength measured on the knee extensors increased by 9.9 and 10.6% for the left lower limb after EMS and conventional exercise, respectively ($P < 0.05$) and by 9.5 and 12% for the right lower limb ($P < 0.05$).
Eicher <i>et al.</i> [17]	França	24	Patients with stable CHF	Classical bicycle training program	Electrical stimulation of inferior limb muscles	Functional capacity	Distance walked in 6 minutes improved significantly in both groups. It improved more in the EMS group (+ 72m) than in the bicycle group (+ 29m)
Harris <i>et al.</i> [18]	UK	46	Stable NYHA Class II/III heart failure	6-week training programme using either a bicycle	Electrical stimulation of the quadriceps and gastrocnemius	Functional capacity, quality of life and	Significant increases were seen in 6-min walk (44.6 m, 95% confidence interval (CI) 29.3–60.9

				ergometer	muscles.	muscle strength	m) and similar significant increases were seen following training for 6-min walk (40.6 m, 95% CI 28.2–53.0 m), Maximum leg strength (5.32 kg, 95% CI 3.18–7.45 kg) and maximum leg strength (5.35 kg, 95% CI 1.53–9.17 kg) Quality of life scores improved following training when the bicycle and stimulator groups were considered together, but not when considered separately (–0.43, 95% CI –8.13 to –0.56).
Karavidas <i>et al.</i> 2013 [19]	Greece	30	Patients with chronic HFpEF,	Placebo training program	6-week FES training program	Functional capacity and quality of life	A significant improvement in 6-minute walked distance (F = 21.61, P = .001), Kansas City Cardiomyopathy Questionnaire summary (F = 8.68, P = .006), Minnesota Living with Heart Failure Questionnaire (F = 6.43, P = .017)
Araújo <i>et al.</i> [20]	Brazil	30	Patients hospitalized in the ward for the treatment of heart failure at a tertiary cardiology hospital.	Did not receive NMES	Underwent conventional rehabilitation and NMES for 60 minutes (20 Hz wave frequency, 20 μ s pulse duration), twice a day, on consecutive days until hospital discharge	Functional capacity	Distance covered in meters on the 6MWT by patients undergoing NMES before: 372.9 $\pm$ 62.4 and after: 500 $\pm$ 68, p < 0.001. The control group patients had before: 379.7 $\pm$ 43.5 and after: 372.9 $\pm$ 46.9
Banerjee <i>et al.</i> [21]	UK	18	Stable CHF from left ventricular systolic dysfunction with New	8-week control period during which they	8-week EMS training program	Functional capacity and muscle strength	6MWT and quads strength compared with both baseline values and the control response

			York Heart Association Class II-III symptoms	maintained their habitual activity level			
Karavidas <i>et al.</i> 2008 [22]	Greece	30	Patients with stable CHF	Placebo	6-week FES training program	Functional capacity and quality of life	A significant improvement in KCCQ functional ($F = 76.666$, $p < 0.001$), KCCQ overall ($F = 41.508$, $p < 0.001$) was observed in the FES group compared to placebo. Patients in the FES group had also a significant increase in 6MWT ($F = 19.413$, $p < 0.001$) compared to placebo.
Karavidas <i>et al.</i> 2006 [23]	Greece	24	Patients with a left ventricular ejection fraction of less than 40% and New York Heart Association class II-III symptom	Received current input up to the sensory threshold without muscle contractions.	6-week training programme of FES	Functional capacity and quality of life	A significant improvement on the 6-min walk test ($7.5 \pm 3.3\%$) and Minnesota Living Score ($18.2 \pm 8.6\%$) was observed only in the FES-treated group.
Nuhr <i>et al.</i> [24]	Austria	32	Patients with a diagnosis of chronic heart failure	NMES up to the sensory threshold without muscle contractions	NMES that generated muscle contractions; (Pulse width of 0.5 ms and frequency of 15 Hz)	Functional capacity and quality of life	The quality of life score decreased in the intervention group (53 ± 20 , $P < 0.001$), while the control group remained unchanged (66 ± 22 , ns). In the 6-minute walk test (6MWT), a significant difference was observed: Intervention group (227 ± 138 m vs 299 ± 137 m). Control group (237 ± 132 m vs 243 ± 145 m)
Quittan <i>et al.</i> [25]	Austria	42	Patients with stable disease progression listed for transplantation	NMES up to the sensory threshold without muscle contractions.	The patients received daily NMES sessions, twice a day, for 8 weeks, with a frequency of	Muscle strength and quality of life	Muscle strength increased by an average of 22.7 for the knee extensor muscles and 35.4 for the knee flexor muscles. The Control Group remained unchanged or decreased by -8.4 in extensor

					50 Hz and a duty cycle (on/off regime)		strength. Cross-sectional area increased by 15.5 in the Stimulation Group and 1.7 in the Control Group. Activities of daily living and quality of life improved in the Stimulation Group, but not in the Control Group.
Groehs <i>et al.</i> [26]	Brazil	30	Patients hospitalized with decompensated heart failure.	Electrical stimulation with an intensity < 20 mA	Functional electrical stimulation consisted of stimulating the lower limbs with a frequency of 10 Hz, pulse width of 150 ms, and intensity of 70 mA for 60 minutes/day over 8 to 10 consecutive days	Functional capacity, muscle strength, and quality of life	Both the FES group and the control group showed an increase in the results of the walking test ($p < 0.001$ and $p = 0.001$, respectively). However, the distance covered was greater in the FES group than in the control group ($p < 0.001$). Knee extensor muscle strength increased in the FES group ($p < 0.001$), but not in the control group. Comparisons between the groups revealed that the quality of life score was higher in the FES group than in the control group ($p < 0.001$).
Sacilotto <i>et al.</i> [27]	Brazil	28	Patients with severe heart failure	The application of the current did not induce muscle contraction.	The stimulation was applied, inducing visible muscle contraction, twice a week for a period of 7 days per week, 50 minutes (pulse frequency of 50 Hz, rise/fall time of 2/2 seconds, and contraction/relaxation time of 3/9 seconds, respectively).	Quality of life and functional capacity	The distance covered in the 6-minute walk test (6MWT) increased immediately after the completion of the NMES protocol when compared to the distance covered before the NMES treatment: 324 ± 117 m vs 445 ± 100 m, $p = 0.02$. The placebo group showed no differences in the 6MWT values before and after the treatment. In the NMES group, there was a significant reduction in the scores obtained through the Quality of Life

							Questionnaire (QQV), indicating an improvement in quality of life (64 ± 22 vs 45 ± 17 , $p < 0.01$)
Kucio <i>et al.</i> [28]	Poland	72	Patients with stable CHF	Received solely pharmacological and exercise treatment	Administered NMES	Quality of life and functional capacity	Three weeks of rehabilitation induced significant increases ($p < 0.05$) in the distance covered in the 6-minute walk test and improved quality of life in all groups, but between group differences were not significant ($p > 0.05$).
Forestieri <i>et al.</i> [29]	Brazil	70	Patients hospitalized with advanced decompensated heart failure	They did not receive NMES, only standard care	A biphasic current of 40 Hz, pulse duration of 400 μ s, 'on-time' mode of 10 seconds and 'off-time' of 20 seconds, with a maximum amplitude of 60 mA, was increased according to the patient's tolerance until a muscle contraction was observed. The treatment lasted for 2 weeks, twice a day, for 60 minutes.	Functional capacity	Regarding functional capacity, the groups were homogeneous at baseline, and a significant improvement in the distance covered in the 6-minute walk test was observed in both groups post-protocol compared to baseline values ($p < 0.05$). However, the EMS group showed a significantly greater increase compared to the control group after the protocol application ($p < 0.001$), relative to baseline ($p < 0.001$)
Kadoglou <i>et al.</i> [30]	Greece	120	With stable (without recent decompensation) CHF (NYHA class II/III and left ventricular ejection fraction $<40\%$)	Lower intensity stimulation (5 Hz), not leading to visible or palpable contractions.	Visible muscle contractions by arranging the delivery of a direct electrical current at 25 Hz for 5 seconds followed by a 5-second rest by each stimulator.	Functional capacity	6MWT was significantly improved in the FES group (treatment effect on 6MWT change 41.8, 95% CI 34.6–48.9)

Ennis <i>et al.</i> [31]	UK	60	Randomised feasibility trial into the effects of low-frequency electrical muscle stimulation in advanced heart failure patients.	Very low level of stimulation (LF-EMS) (frequency: 99Hz, pulse width: 150 μ s, maximum current amplitude: 7.3 mA)	Rhythmical contractions in the leg muscle groups	Functional capacity, muscle strength and Quality of life	Non-significant improvements after LF-EMS (8week time point) and sham groups were observed in 6 min walk distance (6MWD) with a mean increase from baseline of 24m ($p=0.13$) in the LF-EMS group No significant differences between groups in the change from baseline for muscle strength. There was a non-significant improvement in quality of life in both groups.
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EMS = electrical myostimulation; LFES = low-frequency electrical stimulation; NYHA = New York Heart Association; CHF ==Chronic Heart Failure; HFpEF = Heart Failure preserved ejection fraction; FES = Functional Electrical Stimulation; 6MWT = 6 minute walk test; KCCQ - Kansas City Cardiomyopathy Questionnaire