Waltz Dancing in Patients With Chronic Heart Failure
New Form of Exercise Training

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***Background*—**There is evidence that aerobic exercise improves functional capacity in patients with New York Heart Association (NYHA) class II and III chronic heart failure. However, it is unknown whether dancing is safe and able to improve functional capacity in patients with chronic heart failure.

***Methods and Results*—**We prospectively studied 130 patients with stable chronic heart failure (107 men; mean age, 59±11 years) in New York Heart Association class II and III and left ventricle ejection fraction <40%. Patients were randomized to supervised aerobic exercise training at 70% of peak $\dot{V}O_2$ 3 times a week for 8 weeks (group E, n=44) or to a dance protocol of alternate slow (5 minutes) and fast (3 minutes) waltz lasting 21 minutes (group D, n=44). A group that did not undergo exercise training served as control (group C, n=42). On study entry and at 8 weeks, all patients underwent cardiopulmonary exercise testing on a cycle ergometer until volitional fatigue, 2D-echo with Doppler, and endothelium-dependent dilation of the brachial artery. Heart rate was 111±15 bpm during exercise training and 113±19 bpm during dancing (P=0.59). Peak $\dot{V}O_2$, anaerobic threshold, $\dot{V}E/\dot{V}CO_2$ slope, and $\dot{V}O_2$/W slope were all similarly improved in both E and D groups (+16% and 18%, 20% and 21%, 14% and 15%, 18% and 19%, respectively; P not significant for all comparisons; P<0.001 versus controls). Endothelium-dependent relaxation was also similarly improved (group E, from 2.6±1.3% to 5.2±1.5%, P<0.001 versus control; group D, from 2.2±1.4% to 5.0±1.5%, P<0.001 versus control for both E and D). The change in peak $\dot{V}O_2$ in E and D groups was correlated with changes in peak velocity of early filling wave/peak velocity of late filling ratio (r=−0.58, P<0.001) and endothelium-dependent dilation (r=0.64, P<0.001). Untoward events were rare in both E and D groups.

***Conclusions*—**In patients with stable chronic heart failure, waltz dancing is safe and able to improve functional capacity and endothelium-dependent dilation similar to traditional aerobic exercise training. Waltz dancing may be considered in clinical practice in combination with aerobic exercise training or as an alternative to it. **(*Circ Heart Fail.* 2008;1:107-114.)**

Key Words: dancing ■ heart diseases ■ exercise ■ exercise training

There is evidence that moderate-intensity aerobic exercise improves functional capacity and quality of life of healthy as well as cardiac patients with normal or depressed cardiovascular function.[1] Physical activity has been associated with a reduced risk of cardiovascular disease in epidemiological studies both in men and women.[2] Federal guidelines from the Centers for Disease Control and Prevention and the American College of Sports Medicine,[3] as well as the Surgeon General's Report on Physical Activity and Health,[4] endorse at least 30 minutes of moderate-intensity physical activity on most, and preferably all, days of the week, in contrast to earlier guidelines that recommended vigorous endurance exercise for at least 20 minutes 3 or more times per week.

By converse, sedentary lifestyle is considered as a risk factor for atherosclerosis and coronary artery disease. A sedentary lifestyle is one of the 5 major risk factors (along with high blood pressure, abnormal values for blood lipids, smoking, and obesity) for cardiovascular disease, as outlined by the American Heart Association. As many as 250 000 deaths per year in the United States are attributable to a lack of regular physical activity.[5]

Clinical Perspective see p 114

In chronic heart failure (CHF), exercise training is recommended in condition of clinical stability to improve functional capacity and quality of life and to relieve symptoms.[6] The results of randomized, controlled trials demonstrate that these improvements are related, among others, to enhanced skeletal muscle oxidative capacity, endothelial function, catecholamine spillover, and oxygen extraction.[7–12] The long-term maintenance of improved functional capacity seems to

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Table 1. Clinical Characteristics of Study Population

	Exercise	Dance	Control
N (M/F)	44 (38/6)	44 (36/8)	42 (35/7)
Mean age, y	59±10	60±11	58±10
Previous cardiac disease, n			
Myocardial infarction	24	25	21
PTCA/stenting	15	14	12
CABG	34	36	29
NYHA II/III, %	70/30	70/30	70/30
LV ejection fraction, %	35±8	36±7	37±8
Medication, n			
Digitalis	5	6	4
Diuretics	34	32	29
ACE inhibitors	34	35	37
β-Blockers	36	35	37
Nitrates	11	8	9
Statins	26	25	22

M indicates male; F, female; PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass surgery; NYHA, New York Heart Association; LV, left ventricle; ACE, angiotensin-converting enzyme. Coronary lesion score was calculated as the average of significant coronary artery stenoses.

be of fundamental importance in reducing the rate of hospital readmission and to improve outcome.[13] Despite these important results, the adherence to exercise training programs is variable among centers, depending on clinical, social, personal, and many other reasons. A failure to complete an exercise training program is frequently due to the lack of enthusiasm among participants. As a result, many patients quit the program too early to obtain benefits.

To stimulate people to exercise, alternative forms of exercise should be found. One of those may be dancing. Dance is a form of exercise that combines movement, social interaction, and fun. People involved in courses of dance are generally well motivated to continue the program until the end, with a low rate of withdrawal. However, there are no data on its potential clinical benefits in patients with cardiac disease in general and heart failure in particular.

The primary end point of the study was to determine whether dance improves functional capacity and quality of life as exercise training in patients with CHF and whether the compliance is acceptable. Secondary end points were the effect of dance on indices of cardiovascular efficiency assessed by cardiopulmonary exercise testing and on the endothelium-dependent vasorelaxation.

Methods

From September 2001 to November 2003, we prospectively studied 130 patients with stable CHF (107 men; mean age, 59±11 years) in New York Heart Association (NYHA) class II and III and left ventricle ejection fraction <40% (Table 1). All patients were able to dance and practiced different types of dances in the past. However, none practiced agonistic dance. Of 168 patients who were approached, 30 refused to participate. Patients assessed for eligibility were initially 138 (107 M/31 F). Of them, 8 were excluded (2E, 2D, 4C) and 130 were randomized. Inclusion criteria were clinical stability during the last 3 months and ability to perform exercise. Exclusion criteria were a recent acute coronary syndrome or coronary interventions or both, renal insufficiency (serum creatinine >2.5 mg/dL), liver abnormalities, uncontrolled hypertension, and orthopedic and/or neurological limitations.

Study Design

The protocol was approved by the local Ethical Committee. Patients were randomized after a run-in period of 1 week, during which they signed an informed written consent form, and were visited by a cardiologist. The protocol was designed according to CONSORT statement suggestions.[14] Patients were randomized to supervised exercise training (cycling, treadmill) at 70% of peak $\dot{V}O_2$ 3 times a week for 8 weeks (group E, n=44) or to a dance protocol (group D, n=44). A group was not exercised and served as control (group C, n=42). They remained in the same allocation throughout the study period. A computer-generated randomization list was drawn up by an independent statistician. Dance sessions were performed at the hospital's gym 3 times a week for 8 weeks. Heart rate was monitored during exercise sessions and dancing in all patients. On study entry and at 8 weeks, all patients underwent cardiopulmonary exercise testing, 2D-echo with Doppler, endothelium-dependent dilation of the brachial artery, and blood chemistry.

Dance Protocol

Dance sessions were performed at the hospital's gym. Under heart rate monitoring, patients started the dance protocol after a warm-up phase of calisthenics, which lasted 10 minutes. The dance chosen was waltz, because of its wide popularity in many countries and the potential generalizability of the results. The sequence of waltz was 5 minutes of slow waltz, 3 minutes of fast waltz, 5 minutes slow, 3 minutes fast, and 5 minutes slow (total 21 minutes). The intensity of dance training was presumed to be similar to that of traditional training, because it was calculated as the heart rate corresponding to 70% of peak $\dot{V}O_2$. Energy expenditure (EE) during dancing was calculated as recommended by the American College of Sports Medicine (EE=metabolic equivalents of task (METs) × 3.5 × body weight/200). A cool down period after the last waltz was allowed for all patients. Patients danced during all sessions in couple with a partner experienced in dancing. If the habitual partner was unavailable, 2 patients completed the dancing session together.

Exercise Training

A supervised exercise training program was performed at the hospital's gym, 3 times a week for 8 weeks, as previously described.[13] Exercise intensity was chosen at 70% of peak $\dot{V}O_2$. Each session lasted about 1 hour, which began with calisthenics for 10 minutes, followed by 30 minutes of aerobic exercise on an electronically braked cycle ergometer (Ergometrics 800 S) or treadmill (Tunturi, Finland) or both. Heart rate was maintained at target intensity for 30 minutes of cycling and was adjusted during training. Blood pressure was measured at rest, at the end of exercise, and after 5 minutes of recovery. Patients were asked to avoid regular exercise at home during the study period.

Blood Chemistry

Plasma lipids and glucose were measured on a Hitachi 917 biochemical analyzer (Hitachi, Tokyo, Japan) by using conventional enzymatic methods (Boehringer Mannheim, Mannheim, Germany). Malondialdehyde levels in plasma samples were measured by using high-performance liquid chromatography with fluorescence detection. Total plasma lipid hydroperoxide concentrations were measured by using the ferrous oxidation-xylenol orange assay in conjunction with triphenyl phosphine as previously described.[15]

Cardiopulmonary Exercise Testing

After a familiarization test, a symptom-limited cardiopulmonary exercise test was performed on an electronically braked cycle ergometer by using a ramp-pattern increase in work rate. All the exercise tests were performed in the morning at least 3 hours after a light breakfast. Expired gases and volumes were analyzed, breath-by-breath, with a metabolic cart (QUARK PFT, COSMED, Rome). Heart rate and blood pressure were measured every minute during increasing work rate exercise and recovery. A 12-lead ECG was recorded every minute. The exercise test was stopped when one or more of the following criteria were present: fatigue, dyspnea, excessive systemic blood pressure increase (≥230/130 mm Hg), ≥2-mm ST depression in at least 2 adjacent leads, and/or angina. The anaerobic threshold was measured by the V-slope method.[16] Peak oxygen uptake was the average oxygen uptake during the last 15 seconds of exercise.

Ultrasound Cardiac Imaging

Echocardiographic studies were performed with the patients supine in the left lateral position. Two-dimensional echo images were continuously acquired from the parasternal long axis, short axis, and apical 4- and 2-chamber views by using an electronic scanner (3.5 MHz, Megas, ESAOTE, Italy). End-diastolic and end-systolic volumes were obtained from the apical view by using a modified single-plane Simpson's rule from which ejection fraction was calculated. Left ventricular flow velocity waveforms from 5 consecutive cardiac cycles were obtained and averaged by positioning the sample size on the mitral leaflet tips during diastole.

Peak velocity of early filling wave (E), peak velocity of late filling (A), and their ratio were then calculated. The echocardiographic images were evaluated in a blinded manner by 2 independent, experienced observers who adopted the same assessment criteria. Disagreement between the 2 observers occurred in 8% of studies. Differences in interpretation were resolved by a third independent cardiologist.

Brachial Artery Vasomotor Function

Patients were evaluated in the morning in a fasting state as previously described.[17] After 5 minutes of relaxation in the supine position, a 7.5-MHz ultrasound probe was positioned over the dominant arm to detect good quality brachial artery images (ESAOTE Challenge, Florence, Italy). Acquisition started after fixation of the probe in a stereotaxic arm to avoid artifacts due to operator movements. Images were taken at baseline for 30 seconds and 90 seconds after cuff release (flow-mediated response) according to recently published recommendations.[17] Flow-mediated dilatation was evaluated after release of a small (pediatric size) sphygmomanometer inflated at 240 mm Hg for 4.5 minutes at the wrist. We considered a ≥7% change in diameter from resting values as a normal response (2 SD of the difference between repeated measurements at our laboratory and other laboratories).[17,18] Images were evaluated by 2 independent experienced operators unaware of the clinical picture and blinded as to each other's interpretation. Intraobserver and interobserver variabilities were assessed in 250 consecutive subjects with a variety of conditions, and results were in agreement with those of other laboratories (1.2±0.8% and 1.9±0.9%, respectively).

Quality of Life

The Minnesota Living With Heart Failure Questionnaire (MHFLQ) was used.[19] This method contains 21 self-administered items with 3 domains: the effects of heart failure on (1) physical, (2) emotional, and (3) socioeconomic factors.

Statistical Analysis

Data were analyzed by SPSS 13.0 (for Windows) statistical package. The distribution was normal for all variables considered. We used one-way ANOVA to compare variables at baseline and changes from baseline to 8 weeks and post hoc analysis with the Dunnett's test to compare each group to the control group.

Regression analysis was performed to determine the relationship between changes in peak $\dot{V}O_2$ and changes in E/A ratio, endothelium-dependent relaxation, and quality of life. Univariate analysis was also performed to assess the independent predictors of change in functional capacity after dancing. From previous studies from our laboratory, we calculated a number of patients of 42 per group for a power of 80% and $\alpha=0.05$ to determine a 15% difference in peak $\dot{V}O_2$ between study entry and the end of exercise training. Data are expressed as mean±SD, with a significance level $P<0.05$.

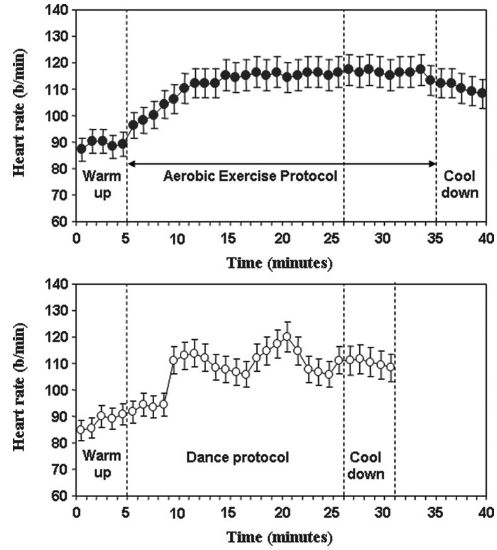

Figure 1. Sixty-second average heart rate during exercise training (closed circles) and dancing (open circles) in all patients. After a 5-minute warm-up, the exercise phase started and lasted 21 minutes (dance) or 30 minutes (exercise training). A 5-minute cool down followed both the dance and the exercise training phases. Differences between the 2 profiles were not statistically significant. For details, see text.

Results

At baseline, there was no difference in medications among groups. Medical treatment did not change during the study. Of 130 patients who were randomized, 128 completed the protocol. Two male patients, 1 in the dance group and 1 in the training group, were withdrawn from the study for personal reasons unrelated to health.

Figure 1 shows the average heart rate monitored during the dance protocol and during exercise training in all subjects. The average heart rate was 111±15 bpm during exercise training, and it was 113±19 bpm during dancing ($P=0.59$). However, the 2 heart rate profiles look differently, despite any difference between the mean heart rate during the 2 exercise modalities: stable during exercise training and oscillations during dancing (Figure 1). The duration of the 2 protocols was also different: 21 minutes for the dance protocol and 30 minutes for the traditional training. There were no differences in heart rate response during waltz dancing in relation to the partner. Presumably, the cost of exercise was not different.

Energy Expenditure

EE was not directly measured. We monitored gas exchange and ventilation with a portable analyzer (K4b2, Cosmed, Rome) in a group of patients participating in the study. In the 15 patients studied (10 men, 5 women; age, 60±9 years; weight, 77±17 kg), mean $\dot{V}O_2$ was 14.3 mL/

Table 2. Cardiopulmonary Exercise Testing Results

	Exercise Training		Dance		Control	
	Entry	8 wk	Entry	8 wk	Entry	8 wk
Peak $\dot{V}O_2$, mL/(kg·min)	16.5±4.5	19.6±4.5*	16.8±5.0	19.5±5.0*	16.1±4.5	15.8±4.5
$\dot{V}O_2$AT, mL/(kg·min)	9.8±3.2	11.9±3.0*	9.9±3.4	11.6±3.3*	9.6±3.0	9.4±3.0
$\dot{V}E/\dot{V}CO_2$ slope	39.5±11	31.8±12*	38.8±12	32.5±12*	39.1±13	38.9±11
$\dot{V}O_2$/W slope	8.3±1.5	9.5±1.3*	8.1±1.3	9.4±1.1*	8.4±1.1	8.3±1.1
Peak O_2 pulse, mL beat	10.5±1.8	12.3±1.8*	10.7±1.7	12.6±1.7*	10.2±1.6	10.5±1.6
RER	1.18±0.9	1.20±1.0	1.17±0.8	1.20±0.9*	1.16±1.0	1.17±1.0
Peak heart rate, bpm	129±15	135±16*	131±14	138±16*	132±13	131±14
Systolic blood pressure, mm Hg	155±18	168±16*	150±20	165±20*	148±18	150±20

RER indicates respiratory exchange ratio.
*P<0.05 vs controls.

(kg·min), corresponding to 4.1 METs. In this group, EE was calculated as 5.4 kcal/min or 113 kcal for 21 minutes of dancing exercise. A similar result is obtained by multiplying oxygen uptake by 5 kcal.

Cardiopulmonary Exercise Testing

After 8 weeks, peak $\dot{V}O_2$, anaerobic threshold, $\dot{V}E/\dot{V}CO_2$ slope, and $\dot{V}O_2$/W slope were all similarly improved in both groups E and D (16% and 19%, 20% and 21%, 14% and 15%, 18% and 19%, respectively; P not significant for all comparisons, P<0.001 versus controls). Oxygen pulse, a good approximation of stroke volume, was also similarly improved in the 2 exercise groups (Table 2). We analyzed the relationship between baseline values for the measured variables and the percent change in peak $\dot{V}O_2$ after dancing. The strongest independent predictors of peak $\dot{V}O_2$ change were the initial peak $\dot{V}O_2$ (r=−0.61), E/A ratio (r=−0.54), and age (r=−0.32) (P<0.001 for all). Gender did not enter in the model.

Endothelium-Dependent Relaxation

As shown in Figure 2, the endothelium-dependent relaxation was improved in the 2 groups (group E, from 2.6±1.3% to 5.2±1.5%, P<0.001 versus control; group D, from 2.2±1.4% to 5.0±1.5%, P<0.001 versus control). However, the improvement was not significantly different between dancing and exercise groups (P=0.51).

Echocardiography

Ejection fraction was not significantly changed in both E and D groups (Table 3). However, mitral inflow diastolic filling pattern was changed as a result of changes in the E/A ratio in both E and D groups (P<0.05 versus controls; P=0.44, E versus D).

Blood Chemistry

Total cholesterol was not significantly reduced in both dancing and exercise training groups (group E: from 198±25 mg/dL to 195±24 mg/dL; group D: from 191±24 to 186±24; P=0.43). Low-density lipoprotein cholesterol had no significant changes from baseline in the 3 groups. However, high-density lipoprotein cholesterol and triglycerides were both improved at the end of the protocol in both E and D groups (high-density lipoprotein cholesterol, group E: from 33±10 mg/dL to 37±11 mg/dL, group D: from 35±9 to 39.5±8; P<0.02 versus controls; triglycerides, group E: from 182±21 mg/dL to 165±22 mg/dL, group D: from 175±23 to 144±22; P<0.01 versus controls). Fasting blood glucose was also reduced in the 2 exercise groups (group E: from 101±13

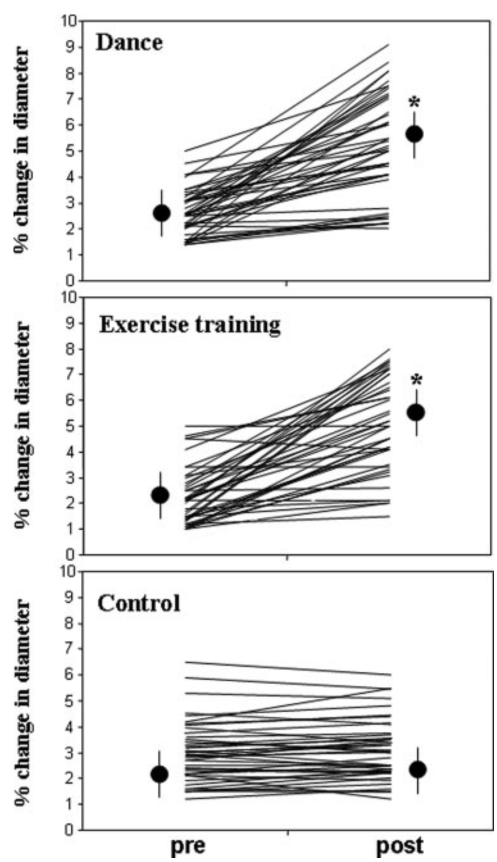

Figure 2. Pre-post values of endothelium-dependent relaxation in each subject of the 3 groups. Filled circles are mean with standard deviation, *P<0.001 vs control. For explanations, see text.

Table 3. Echocardiographic Results

	Exercise Training		Dance		Control	
	Entry	8 wk	Entry	8 wk	Entry	8 wk
Left ventricular end-diastolic volume, mL	196±16	199±18	199±18	198±18	201±19	202±19
Left ventricular end-systolic volume, mL	127±14	121±15	130±16	120±17	126±19	127±19
Left ventricular ejection fraction, %	35±8	39±8	36±7	39±7	37±8	38±8
E/A ratio	0.92±0.8	0.64±0.8	0.98±0.9	0.56±1.1*	0.95±0.9	0.93±0.9

E/A indicates peak velocity of early filling wave/peak velocity of late filling ratio.
*$P<0.05$ vs controls.

g/dL to 91±12 g/dL; group D: from 98±12 to 88±11; $P<0.03$ versus control).

Systemic Oxidative Markers

In dancing patients, there was a significant decrease in both plasma malondialdehyde (from 3.75±0.8 μmol/L to 2.36±0.8 μmol/L) and lipid hydroperoxide levels (from 3.88±0.9 μmol/L to 2.21±0.9 μmol/L) as compared with controls ($P<0.001$ for both). Similar changes were observed in exercise training patients (from 3.81±0.8 μmol/L to 2.44±0.8 μmol/L and from 3.96±1.0 μmol/L to 2.45±0.9 μmol/L, respectively, $P<0.001$ versus controls).

Quality of Life

As shown in Figure 3, the MHFLQ sum score improved significantly after both dancing and exercise training ($P<0.001$ versus controls). However, the improvement after dancing was not different from the improvement after aerobic exercise ($P=0.40$). The 3 domains changed are as follows: physical (group D: from 35±8 to 27±9; group E: from 33±7 to 25±8; controls from 35±9 to 33±9), emotional (group D: from 10±5 to 4±4; group E: from 11±4 to 8±4; controls from 10±4 to 9±4), and socioeconomic (group D: from 10±6 to 7±6; group E: from 9±6 to 7±5; controls from 10±6 to 10±6). The adherence to the protocol, calculated as the percentage of training sessions attended, was higher in group D than in group E (91±8% versus 77±8%, $P<0.02$).

Correlations

Changes in peak $\dot{V}O_2$ were correlated with changes in the E/A ratio ($r=-0.58$, $P<0.001$), changes in the endothelium-dependent relaxation ($r=0.64$, $P<0.001$) (Figure 4), and changes in quality of life sum score ($r=0.68$, $P<0.001$). Correlation coefficients were not different between dancing and aerobic exercise.

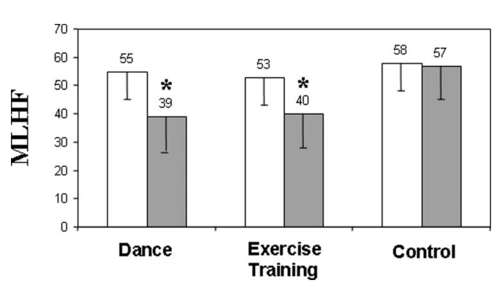

Figure 3. Quality of life assessed by Minnesota Living with Heart Failure Questionnaire sum score in the dance, exercise training, and control groups at baseline (empty bars) and at the end of protocol (filled bars). *$P<0.001$ vs control.

Untoward Events

During both exercise training and dancing, there were minor untoward events. There were no significant differences in systolic blood pressure at rest and recovery in both groups. Sporadic ventricular premature contractions were observed in 6 patients during the exercise training sessions and 8 patients during dancing. Other mild events were dizziness (1E, 2D patients) and hypotension during recovery (2D patients).

Discussion

The results of the present investigation demonstrate that waltz dancing improves functional capacity in patients with New York Heart Association class II and III CHF without meaningful side effects. This improvement was similar to that observed after a supervised moderate exercise training program and was correlated with enhanced quality of life in both exercise groups.

Functional Capacity

This is the first demonstration that a dance protocol improves functional capacity in humans with CHF. Peak $\dot{V}O_2$ increased by 19% in the dancing group and 16% in the exercise training group ($P=0.69$). The improvement in peak $\dot{V}O_2$ after dancing was predicted by the initial peak $\dot{V}O_2$, as well as E/A ratio and age. Gender did not enter in the model. The amount of improvement in peak $\dot{V}O_2$ was similar to that of a recent meta-analysis in 800 patients with similar characteristics (17%; range, 12% to 31%).[20] In the present study, in both groups, the increased functional capacity was accompanied by significant improvements in ventilation and cardiocirculatory efficiency, as demonstrated by changes in the $\dot{V}E/\dot{V}CO_2$ slope, $\dot{V}O_2$/W slope, and O_2 pulse, respectively (Table 2). The average heart rate during dance was similar to that recorded during traditional aerobic exercise, but the duration of the waltz protocol was 43% shorter (21 minutes versus 30 minutes).

The profile of heart rate responses during dancing resembles that observed during interval training exercise. On-off exercise may correspond to the sequence slow-fast waltz dance we used (Figure 1).

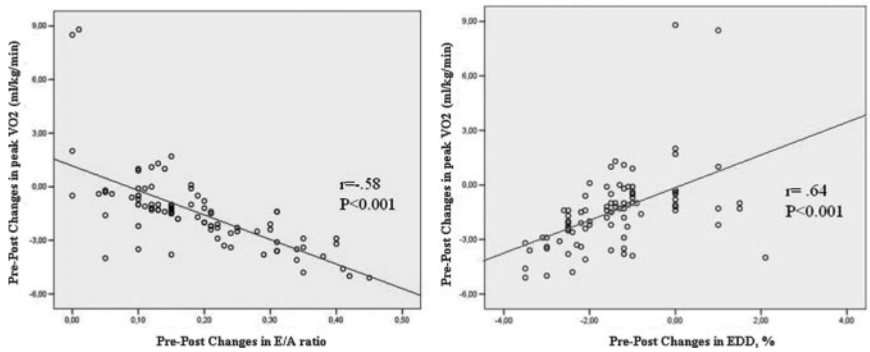

Figure 4. Correlation between pre-post changes in peak $\dot{V}O_2$ and pre-post changes in E/A ratio and endothelium-dependent relaxation in E and D groups. For explanation, see text.

As recently shown, intermittent exercise determined more marked improvements in functional capacity and endothelium-dependent brachial artery relaxation than did continuous aerobic exercise in a group of CHF patients clinically similar to those studied in the present investigation. As shown by Wisloff et al,[21] interval training rather than continuous exercise was associated with a more marked increase in total antioxidant status, and this improvement was correlated with improved endothelium-dependent vasorelaxation (r=0.67). Although pre-post changes in peak $\dot{V}O_2$ and endothelium-dependent dilation observed in this study were in agreement with the results described by Wisloff et al, we found similar decreases in plasma malondialdehyde and lipid hydroperoxide, as compared with initial values, in dancing and exercise training groups. This parallel reduction in free radicals was observed, despite different exercise protocols.

Dancing is a form of exercise that induces favorable effects similar to aerobic exercise training. Both central and peripheral adaptations have been demonstrated in humans with CHF after moderate-intensity aerobic exercise. Exercise training enhances cardiac output at peak workload, improves myocardial perfusion and function, increases the size and volume density of mitochondria and skeletal muscle oxidative enzymes as well, reduces endothelial dysfunction, and improves autonomic balance.[7–12] The mechanisms through which dancing improves functional capacity and endothelial dysfunction have not been demonstrated in the past. From the result of the present investigation, we may hypothesize similar adaptations as aerobic exercise training. In fact, correlation coefficients of the relationship between changes in peak $\dot{V}O_2$ versus E/A ratio and endothelium-dependent dilation were not different between dancing and aerobic exercise training groups. On the basis of the results of the present investigation, 2 factors seem to play a role in improving functional capacity. One is left ventricle diastolic filling, and the other is the endothelium-dependent vasorelaxation. Previously, our group demonstrated that aerobic exercise improves left ventricle diastolic filling in patients with CHF, which was correlated with peak $\dot{V}O_2$ increase.[22] The results of the present study are in agreement with previous evidence showing that the increase in peak $\dot{V}O_2$ is related to improvements in the endothelium-dependent vasorelaxation.[23] However, we did not observe any difference between dance and aerobic exercise. At 8 weeks, an increase in high-density lipoprotein cholesterol was observed in both groups and may explain, at least in part, the enhanced endothelium-dependent vasomotor response. The reduction in plasma triglycerides may contribute to this effect, together with a decrease in malondialdehyde and lipid hydroperoxide.

Quality of Life

Quality of life was improved in both dance and exercise groups (Figure 3). However, patients involved in the dance protocol, rather than patients randomized to traditional aerobic exercise training, had a more marked improvement in emotional dimension measures of MHFLQ (P=0.04). Moreover, the adherence to the protocol, calculated as the percentage of training sessions attended, was higher in group D than in group E (P<0.02). Evidently, people involved in courses of dance are generally well motivated to continue the program until the end, with a low rate of withdrawal. Dance is a form of exercise in which movement, social interaction, and fun are mixed together. This combination may explain a better compliance with dancing than with traditional exercise training as we observed in the present study.[24]

Dance therapy is offered as a health promotion service for healthy people and as a complementary tool to reduce distress in patients with cancer.[25] Dancing improves mobility and muscle coordination and also reduces muscle tension. More important, dance is reported to improve self-awareness and self-confidence and to facilitate interpersonal sharing of feelings. Not only dance, but also aerobic exercise, increases personal well-being and decreases anxiety and depression.[26]

Limitations

The study was not blinded, neither to the investigators nor to the patients. Dance may not be suitable for all individuals. We tested only 1 dance protocol combining fast and slow waltz. We do not know whether other forms of dance may have the same therapeutic effect. We chose waltz because it represents the most popular dance in the western countries and its choice could guarantee the generalizability of the results obtained. However, the new generation of patients is less experienced with classical dances. This could negatively influence the willingness to participate. The E/A ratio appears to be less accurate than tissue Doppler annular velocity (Ea) to measure ventricular relaxation, because it is more sensitive to alterations in preload. However, changes in the E/A ratio was correlated with pre-post training change in peak $\dot{V}O_2$ in both dance and exercise groups, confirming previous observations in patients with ischemic cardiomyopathy.[22] We did not monitor heart rate during calisthenics. However, because heart rate was monitored just after the end of them, the initial heart rate monitored should presumably reflect the heart rate during calisthenics. If this is true, heart rate during calisthenics should be between 85 and 95 bpm, corresponding to 50% to 55% of peak $\dot{V}O_2$ or 60% to 65% of peak heart rate. Adherence in the dancing group may be biased by the presence of an experienced partner. Conversely, this adherence is limited to the 8 weeks of training. Finally, we did not measure EE. However, we may derive it from the basis of $\dot{V}O_2$ measured with a portable analyzer in a small group of participants in the study (see Methods).

Conclusions

The results of the present investigation demonstrate that waltz dancing is safe and improves functional capacity and endothelial dysfunction in patients with CHF. Both improvements were similar to those observed after a supervised moderate exercise training program, despite a 43% shorter protocol. The enhanced functional capacity was correlated with quality of life in both exercise groups. However, patients involved in the dance protocol had a more marked improvement in emotional dimension measures of MHFLQ than did patients randomized to traditional aerobic exercise training ($P=0.04$). Moreover, the adherence to the protocol was higher than that in traditional exercise training. On the basis of the results of the present investigation, waltz dancing may be used in combination with traditional aerobic exercise or as an alternative to it in patients whose adherence to traditional programs is low and/or in those who prefer dancing to other forms of exercise. More studies are needed to confirm these preliminary results, and other forms of dance should also be tested in cardiac rehabilitation programs.

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Disclosures

None.

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CLINICAL PERSPECTIVE

In chronic heart failure, exercise training improves functional capacity and quality of life and also relieves symptoms. The long-term maintenance of these benefits seems to be of fundamental importance in reducing the rate of hospital readmission and to improve the outcome. Despite these important results, the adherence to exercise training programs is variable among centers, depending on clinical, social, personal, and many other reasons. To stimulate people to exercise, alternative forms of exercise should be found. One of those may be dancing. Dance is a form of exercise that combines movement, social interaction, and fun. We prospectively studied 130 patients with stable chronic heart failure (107 males; mean age, 59 ± 11 years) in New York Hart Association classes II and III, who were randomized to supervised aerobic exercise training at 70% of peak $\dot{V}O_2$ 3 times a week for 8 weeks (group E, $n=44$), to a dance protocol of alternate slow (5 minutes) and fast (3 minutes) waltz dancing lasting 21 minutes (group D, $n=44$), or to a control (group C, $n=42$). After 8 weeks, functional capacity, quality of life, and endothelium-dependent relaxation were similarly improved in groups E and D ($P<0.05$ versus group C). However, the emotional dimension of quality of life and the adherence to protocol were both higher in group D than group E. Waltz dancing may be used in combination with traditional aerobic exercise or as an alternative to it in patients whose adherence to traditional programs is low or in those who prefer dancing to other forms of exercise, or both.

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Waltz Dancing in Patients With Chronic Heart Failure: New Form of Exercise Training

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