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Effects of diet combined with Nordic walking or walking programme on weight loss and arterial stiffness in postmenopausal overweight and obese women: The Walking and Aging Verona pilot study

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Nordic walking is a dynamic, aerobic activity which involves the use of both the upper and lower muscles of the body in a rhythmic and continuous manner, and has the advantage of determining a significant increase in oxygen consumption, heart rate and energy expenditure, without significantly increasing rating of perceived exertion.[1] However, whether it gives additional benefits compared with walking in obesity treatment has never been investigated.[2]

We conducted a six-month randomized trial to examine the effects of an intensive lifestyle intervention on weight loss in postmenopausal women with overweight and obesity. We specifically examined whether adoption of a supervised Nordic walking programme in addition to a dietary intervention would promote additional health benefits, such as improving arterial stiffness and reducing cardiovascular risk factors, compared with a dietary intervention combined with a supervised walking programme.

Thirty-two participants were randomized into two groups, diet and supervised Nordic walking 3 times/week (D+NW) and diet and supervised walking 3 times/week (D+W), and followed for six months. Twenty-two (68.7%) completed the six-month follow-up assessments.

Changes in weight, pulse wave velocity (PWV) and biochemical characteristics were assessed at baseline and evaluated at baseline, three- and six-month follow-up. All participants provided written informed consent to participate in the study. The study was registered on ClinicalTrials.gov (CT Identifier NCT03212391).

Participants were eligible if they were between the ages of 50 and 90 years and not involved in a physical exercise programme, lived in Verona and signed an informed consent form.

Candidates were excluded if they had a history of cardiovascular disease or musculoskeletal disease or had enrolled within the past year in a formal weight reduction programme and reported losing more than 5% of current body weight in the previous six months.

During months 1–6, the weekly volume of aerobic exercise consisted of 60–90-min exercise sessions of either Nordic walking or walking, three times a week, under the supervision of a certified Nordic walking instructor. The intensity, expressed in percentage of heart rate reserve (HRR), varied from moderate (40–59% HRR) to vigorous (60–84% HRR). For rating of perceived exertion (RPE), the Borg scale was used.[3]

A certified dietician performed a seven-day dietary recall interview in order to assess the dietary habits of

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each subject enrolled in the study. The record data were then processed by the dietician using special software to calculate daily intake of energy, protein, fat, carbohydrate and alcohol based on the tables furnished by the Italian National Institute of Nutrition.[4]

All the subjects completed a weight-loss programme designed to achieve a loss of 5–10% of the initial weight as previously reported.[5] The caloric restriction was 500 kcal below the resting energy expenditure, as evaluated by indirect calorimetry and multiplied by a physical activity level of 1.4. Each subject received a diet consisting of 62% carbohydrates, 24% fat, 14% protein and 20 g fibre. The subjects underwent monthly clinical and nutritional follow-up. Dietary adherence was checked by a 24-h recall every four weeks during an outpatient visit.

PWV, as a measure of arterial stiffness, was measured with PulsePen (Diatecne, Milan, Italy), a non-invasive portable device.[6]

Table 1. Change in body weight, arterial stiffness and biochemical parameters in two study groups (D + NW, $n = 12$; D + W, $n = 10$).

	Assessment period						*p* value			Linear *p* trend
	Baseline		Month 3		Month 6		Time	Time	Time	
Outcome variable	Mean	SD	Mean	SD	Mean	SD	Month 3 *vs.* baseline	Month 6 *vs.* month 3	Month 6 *vs.* baseline	Group × time interaction
Weight, kg										
D + NW	80.3	11.8	76.0	12.2	75.4	12.6	<0.01	0.157	<0.01	0.995
D + W	80.6	12.4	77.3	12.7	75.7	13.2	=0.001	<0.05	<0.001	
BMI, kg/m^2										
D + NW	33.2	4.9	31.4	5.1	31.1	5.3	<0.01	0.166	<0.01	0.985
D + W	32.9	5.4	31.6	5.6	30.9	5.7	=0.001	<0.05	<0.001	
PWVcr, m/s										
D + NW	6.6	1.0	6.0	1.0	5.9	1.2	=0.246	<0.001	<0.001	0.221
D + W	6.6	1.3	6.3	1.0	6.2	1.0	0.226	0.835	0.241	
PWVcf, m/s										
D + NW	10.5	2.8	10.0	2.9	9.6	3.0	=0.001	<0.05	=0.003	0.375
D + W	10.4	3.3	9.8	3.5	9.8	3.5	<0.05	=0.071	<0.05	
Systolic blood pressure, mmHg										
D + NW	144.2	19.7	143.3	19.0	135.0	17.4	0.638	0.051	0.076	0.778
D + W	145.0	17.3	141.5	14.5	134.0	11.0	0.066	0.076	0.058	
Diastolic blood pressure, mmHg										
D + NW	78.7	9.6	80.0	8.3	77.1	7.5	0.429	0.206	0.394	0.652
D + NW	82.5	11.4	80.0	8.2	79.5	9.0	0.096	0.798	0.217	
Blood glucose, mg/dl										
D + NW	107.7	19.0			103.2	23.4			<0.05	0.996
D + W	104.4	18.7			107.8	17.0			0.099	
Total cholesterol, mg/dl										
D + NW	216.8	39.6			211.7	39.1			0.082	0.788
D + W	213.9	25.8			200.7	26.6			0.545	
LDL cholesterol, mg/dl										
D + NW	126.6	38.7			120.7	38.7			0.053	0.547
D + W	136.7	24.3			119.8	21.5			0.073	
HDL cholesterol, mg/dl										
D + NW	53.2	17.5			59	16.7			<0.05	0.105
D + W	48.4	14.9			50.2	11.5			0.300	
Triglycerides, mg/dl										
D + NW	185.2	80.9			160.1	70.7			<0.05	0.232
D + W	153.4	78.1			138.6	66.4			<0.05	

SD: standard deviation; D + NW: diet + Nordic walking group; D + W: diet + walking group; BMI: body mass index; PWVcr: pulse wave velocity carotid-radial; PWVcf: pulse wave velocity carotid-femoral; LDL: low-density lipoprotein; HDL: high-density lipoprotein.

Retention rates for the NW+D group were 82.9 ± 8.4% at three months and 80.8 ± 11.4% at six months. Retention rates for the W + D group were 86.1 ± 8.8% at three months and 74.7 ± 5.9% at six months.

There were no significant differences in demographics or characteristics that contributed to outcomes between the Nordic walking and walking groups.

Participants who dropped out were similar, in terms of age, weight and body mass index, to those who completed the intervention.

From baseline to six months, weight losses in the D+NW and D+W groups were –4.47 and –3.55 kg (–5.9% and –4.7% of initial body weight, respectively).

Table 1 shows the changes in weight, arterial stiffness and biochemical parameters. Repeated-measures analysis of variance (ANOVA) found a significant time effect on weight for both D+NW and D+W groups ($p < 0.01$ and $p < 0.001$, respectively), but the treatment × time interaction was not significant. The repeated-measures ANOVA using an intent-to-treat approach, assuming no weight change from baseline for those with missing data, found the same pattern of significance.

Repeated-measures ANOVA of the PWVcarotid-radial found a significant time effect for the D+NW but not the D+W group. No significant difference in the treatment × time interaction was observed. A significant reduction at six months in PWVcarotid-femoral was observed in both groups ($p = 0.003$ and $p < 0.05$, respectively), but again the treatment × time interaction was not significant.

Repeated ANOVA found a reduction in blood glucose and an increase in high-density lipoprotein cholesterol only in the D+NW group. For all the biochemical variables the treatment × time interaction was not significant.

During the first three months the study groups engaged in similar amounts of physical activity as measured by the number of steps per day and RPE. At six months, the D+NW group significantly increased the number of steps per day from 7064 ± 1974 to 8579 ± 666 ($p < 0.001$). In the first six months of the D+W group, a significant increase in the number of steps per day from 7462 ± 1667 to 8782 ± 632 was observed. In the two study groups, no significant changes were observed in RPE and in the number of steps from baseline to six months.

During the first three months and also during the second three months, cardiac frequency monitored during physical activity sessions was significantly higher in the D+NW group ($p < 0.05$ and $p < 0.001$, respectively) and RPE significantly lower.

A satisfaction questionnaire was given to the study participants. Nine out of 12 (75%) participants in the D+NW group reported appreciation of the intervention, while in the D+W group, only four (40%) expressed appreciation.

In conclusion, the findings from the present study indicate that a moderate caloric restriction combined with either Nordic walking or walking determines a significant weight loss. Moreover, our findings support the notion that in overweight and obese women, Nordic walking and walking supervised programmes, combined with diet, are both effective in improving arterial stiffness, but that Nordic walking has the further advantage of improving arterial compliance at the upper limb level and is better tolerated as compared with walking.

Additional studies in larger populations, involving both men and women, are clearly needed to determine long-term efficacy and cost-effectiveness of intensive lifestyle interventions similar to those used in our study.

Author contribution

The authors' responsibilities were as follows – APR, FS, CC, MZ: analysis and interpretation of data and preparation of manuscript; APR, FS, CC, MZ: study concept and design and preparation of manuscript; SU, VM, MT: recruited subjects and edited the manuscript; EM, FF: performed tonometry; CM, MT, SU, VM: acquisition of subjects, collection of data and review of the manuscript. All gave final approval and agree to be accountable for all aspects of work ensuring integrity and accuracy.

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