Lampiran 1

JADWAL KEGIATAN PEMBUATAN SKRIPSI : *LITERATUR REVIEW*

EFEKTIVITAS SENAM LANSIA (TAI CHI) DALM PENURUNAN TEKANAN DARAH PADA LANSIA DENGAN HIPERTENSI

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12	Jum't 16/4 2021	Artikel 2 Ace. Silakan v/ silakan. analisis artikel	
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NO.	HARI/TANGGAL	REKOMENDASI	TANDA TANGAN
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Lampiran 4.

Jurnal Keperawatan & Kebidanan - Stikes Dian Husada Mojokerto

PENGARUH SENAM *TAI CHI* TERHADAP PENURUNAN TEKANAN DARAH PADA LANSIA DENGAN HIPERTENSI

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ABSTRAK

Hipertensi merupakan salah satu masalah kesehatan masyarakat yang terjadi di negara maju maupun negara berkembang. Hipertensi yang dialami oleh lansia di Panti Werdha semakin meningkat karena selama ini penanganan hipertensi hanya diberikan terapi farmakologi saja. Salah satu terapi non farmakologi adalah senam *Tai Chi*. Penelitian ini bertujuan untuk menganalisis pengaruh senam *Tai Chi* terhadap Penurunan tekanan darah pada lansia dengan hipertensi di Panti Werdha Mojopahit Mojokerto.

Desain penelitian yang digunakan adalah *Quasy experiment Pre Test-Post Test control group Design*. Populasi seluruh lansia yang mengalami hipertensi di Panti Werdha Mojopahit Mojokerto sebanyak 20 orang, besar sampel pada penelitian ini berjumlah 20 responden dan dibagi menjadi kelompok perlakuan dan kelompok kontrol, dengan teknik *total sampling*. Data yang terkumpul melalui observasi dianalisa deskriptif untuk mengetahui perbedaan perubahan rerata tekanan darah dan di uji statistik *Wilcoxon* dengan tingkat kemaknaan $\alpha = 0,05$.

Hasil analisis didapatkan rerata tekanan darah sistolik *pre-post* pada kelompok eksperimen sebesar 11 mmHg dan rerata tekanan darah diastolik *pre-post* kelompok eksperimen sebesar 9 mmHg. Dari uji statistik diperoleh hasil ada pengaruh senam *Tai Chi* terhadap penurunan tekanan darah dengan nilai signifikasi tekanan darah sistolik *pre-post* pada kelompok eksperimen sebesar 0,007 dan tekanan darah diastolik *pre-post* pada kelompok eksperimen sebesar 0,014.

Dari hasil penelitian di atas membuktikan bahwa senam *Tai Chi* dapat menurunkan tekanan darah pada lansia dengan hipertensi, maka petugas panti perlu memberikan intervensi senam *Tai Chi* sebanyak 3 kali dalam seminggu sebagai pendamping terapi farmakologi dalam mengatasi hipertensi pada lansia.

Kata Kunci : *Senam Tai Chi*, Hipertensi

LATAR BELAKANG

Proses menua (lansia) adalah proses alami yang disertai adanya penurunan kondisi fisik, psikologis maupun sosial yang saling berinteraksi satu sama lain. Penyakit yang sering di alami oleh lansia adalah hipertensi. Hipertensi merupakansalah satu masalah kesehatan masyarakat yang terjadi di negara maju maupun negaraberkembang. Hipertensi menjadi masalah pada usia lanjut karena sering ditemukan dan menjadi lebih dari separuh kematiandiatas usia 60 tahun disebabkan oleh penyakit jantung dan cerebrovaskuler. Nugroho (2008) mengemukakan bahwa hipertensi menjadi masalah pada lanjut usia karena ditemukan dan menjadi faktor utama payah jantung dan penyakit jantung koroner. Modifikasi gaya hidup sebagai langkah pertama dalam perawatan hipertensi, terapi obat-obatan anti hipertensi bersamaan dengan terapi non farmakologi dapat digunakan untuk menurunkan tekanan darah. Obat hanya membuat tekanan darah kembali normal tetapi tidak menjamin tekanan darah naik lagi. Pada lansia, kerja obat dalam tubuh dan interaksinya dengan jaringan tubuh (farmakodinamika) berubah secara signifikan, sehingga memberikan efek kerusakan organ target seperti otak dan ginjal (Christensen, 2006).Hipertensi yang dialami oleh lansia di Panti Werdha Mojopahit Mojokerto semakin meningkat karena selama ini penanganan hipertensi hanya diberikan terapi farmakologi saja.

Hipertensi pada lansia di dunia didapatkan pada tahun 2013 di Amerika menunjukkan penderita hipertensi di seluruh dunia berkisar satu miliar. Di bagian Asia tercatat 38,4 juta penderita hipertensi pada tahun 2013 dan diprediksi akan menjadi 67,4 juta orang pada tahun 2025 (Muhammadun, 2013).Menurut Riskesdas2013 menyatakan bahwa angka hipertensi di Indonesia yang didapat melalui pengukuran pada umur ≥18 tahun sebesar 25,8 persen, sedangkan prevalensi hipertensi di Indonesia berdasarkan umur untuk kelompok umur 45-54 tahun sebesar 35,6 persen, kelompok umur 55-64 tahun sebesar 45,9 persen, kelompok umur 65-74 tahun sebesar 57,6 persen, dan untuk kelompok umur 75 tahun keatas sebesar 63,8 persen, jadi dapat disimpulkan bahwa dengan bertambahnya usia maka rentan terhadap kejadian hipertensi.Prevalensi hipertensi di Jawa Timur yang didapat melalui pengukuran pada umur ≥18 tahun sebesar 26,2 persen.Menurut penelitian Gilbert W. Setiawandkk (2012) tentang Pengaruh Senam Bugar Lanjut Usia (Lansia) Terhadap Kualitas Hidup Penderita Hipertensi menunjukkan adanya pengaruh yang signifikan senam bugar lansia terhadap kualitas hidup penderita hipertensi. Berdasarkan hasil studi pendahuluan yang dilakukan oleh peneliti pada tanggal 10 oktober 2014 di UPT Panti Werdha Mojopahit Mojokerto jumlah lansia yang menderita hipertensi sebanyak 46 % dari 43 lansia dan hanya diberikan terapi farmakologi saja.

Hipertensi merupakan salah satu penyakit yang mempunyai hubungan yang sangat erat dengan lansia. Hal ni terjadi akibat perubahan fisiologis yang terjadi seperti penurunan respons imunitas tubuh, katup jantung menebal dan menjadi kaku, penurunan kemampuan kontraktilitas jantung, berkurangnya elastisitas pembuluh darah, serta kurangnya efektifitas pembuluh darah perifer untuk oksigenasi. Perubahan-perubahan inilah yang menyebabkan peningkatan resistensi vaskuler sehingga lansia cenderung lebih rentan mengalami hipertensi. Lansia sering terkena hipertensi disebabkan oleh kekakuan pada arteri sehingga tekanan darah cenderung meningkat. Selain itu penyebab hipertensi pada lansia juga disebabkan oleh perubahan gaya hidup dan yang lebih penting lagi kemungkinan terjadinya peningkatan tekanan darah tinggi karena bertambahnya usia lebih besar pada orang yang banyak mengkonsumsi makanan yang banyak mengandung garam (Ritu Jain, 2011). Gejalanya berupa sakit kepala, nyeri atau sesak pada dada, pusing, gangguan tidur, terengah-engah saat beraktifitas, jantung berdebar-debar, mimisan, kebal atau kesemutan, gelisah dan mudah marah, keringat berlebihan, kram otot, badan lesu, pembekakan di bawah mata pada pagi hari (Ritu Jain, 2011). Komplikasi jangka panjang tekanan darah tinggi berupa stroke, penyakit ginjal, gagal jantung, penyakit arteri koroner (Samuel Gardner, 2007).

Peran perawat dalam pemberian asuhan keperawatan adalah membantu penderita hipertensi untuk mempertahankan tekanan darah pada tingkat normal dan meningkatkan kualitas kesehatannya secara maksimal. Salah satu penanganan nonfarmakologis pada kejadian hipertensi

yaitu senam *Tai Chi*. Latihan *Tai Chi* merupakan *fewlow-felocity* dan *low impact exercise programs*, yang mempunyai manfaat tinggi bagi lansia dan dapat dilakukan di mana saja. Latihan *Tai Chi* merupakan latihan tradisional dari cina yang menggabungkan latihan pernafasan, rileksasi, dan struktur gerakan yang pelan dan lembut (srisurini,2003). Gerakan *Tai Chi* yang meliputi *body-mind-soul-breath* secara teratur terbukti dapat meningkatkan pelepasan non adrenalin melalui urin, menurunkan kadar cortisol, serta menurunkan aktivitas saraf simpatis yang membawa dampak positif pada jantung (berupa denyut jantung yang stabil dan tekanan darah turun menuju normal). Ini karena aktivitas saraf simpatis dan parasimpatis menjadi seimbang dan harmonis. Latihan tersebut dapat pula meningkatkan antioksidan untuk menghilangkan radikal bebas dalam tubuh dan menstabilkan tekanan darah (Sutanto, 2013).

Tujuan penelitian ini adalah untuk mengetahui pengaruh terapi senam *Tai Chi* terhadap penurunan tekanan darah pada lansia yang tinggal di Unit Pelaksana Teknis Panti Werdha Mojopahit Mojokerto.

METODE PENELITIAN

Jenis penelitian ini adalah eksperimental, karena penelitian ini bertujuan untuk menguji pengaruh variabel independen terhadap variabel dependen, yaitu pengaruh senam *Tai Chi* terhadap perubahan tekanan darah pada lansia. Desain yang digunakan adalah *Quasy Experiment* dengan pendekatan *Pre Test-Post Test Control Group* design yaitu rancangan penelitian yang akan dilakukan oleh peneliti dengan cara peneliti membagi dua kelompok eksperimen dan kelompok kontrol. pemilihan kedua kelompok menggunakan teknik total sampling. Sebelum dilakukan perlakuan (*pre-test*) kedua kelompok akan dilakukan pengukuran tekanan darah, kemudian setelah dilakukan perlakuan (*post-test*) kedua kelompok kembali akan dilakukan pengukuran tekanan darah. Dalam rancangan penelitian ini kelompok eksperimen mendapat perlakuan sedangkan kelompok kontrol tidak. Populasi pada penelitian ini adalah semua lansia yang ada di Panti Werdha Mojopahit Mojokerto berjumlah 43 lansia. Sedangkan populasi terjangkau dalam penelitian ini adalah lansia yang menderita hipertensi di Panti Werdha Mojopahit Mojokerto. Setelah disesuaikan dengan kriteria yang dibuat oleh peneliti yaitu berjumlah 20 lansia. Sampel pada penelitian ini adalah Lansia yang ada di Panti Werdha Mojopahit Mojokerto yang memenuhi kriteria inklusi dan eksklusi. Adapun besar sampel dalam penelitian adalah 20 Lansia. Sampel dikatakan *drop out* bila sampel tidak mengikuti senam taichi lebih dari 3 kali.

Pengambilan sampel pada penelitian ini menggunakan *nonprobability sampling* dengan teknik *total sampling*. Variabel independent pada penelitian ini adalah senam *Tai Chi*. Variabel dependent pada penelitian ini adalah tekanan darah. Setelah data terkumpul melalui observasi, kemudian data ditabulasi dan dikelompokkan sesuai dengan variabel yang diteliti untuk menganalisa terapi senam *Tai Chi* terhadap penurunan tekanan darah pada pasien hipertensi dengan menggunakan uji statistik *Wilcoxon* dengan tingkat kemaknaan *a*=0,05 bila hasilnya diperoleh *a*<0,05 maka Ho ditolak berarti ada pengaruh senam *Tai Chi* terhadap penurunan tekanan darah pada lansia hipertensi.

HASIL PENELITIAN

1. Karakteristik Responden Kelompok Eksperimen

No	Keterangan	Jumlah (orang)	Persentase (%)
1	Jenis kelamin :		
	Laki-laki	3	30
	Perempuan	7	70
2	Usia responden :		
	45-59 tahun	1	10
	60-74 tahun	1	10
	75-90 tahun	7	70
	> 90 tahun	1	10

3	Lama Menderita Hipertensi :		
	< 1 bulan	0	0
	1-6 bulan	0	0
	7-12 bulan	0	0
	> 1 tahun	10	100
4	Cara Mengatasi Hipertensi :		
	Pola hidup sehat	0	0
	Pola makan mengurangi konsumsi garam	0	0
	Mengkonsumsi Obat-obatan	10	100
	Tidak tahu (tidak memperdulikan penyakit)	0	0

Berdasarkan tabel 1. di atas, karakteristik responden berdasarkan jenis kelamin sebagian besar perempuan, yaitu sebanyak 7 responden (70%), sebagian besar berusia 75-90 tahun sebanyak 7 responden (70%), seluruhnya menderita hipertensi > 1 tahun sebanyak 10 responden (100%), dan cara mengatasi hipertensi yaitu 100% dengan cara minum obat-obatan.

2. Karakteristik Responden Kelompok Kontrol

No	Keterangan	Jumlah (orang)	Persentase (%)
1	Jenis kelamin :		
	Laki-laki	3	30
	Perempuan	7	70
2	Usia responden :		
	45-59 tahun	1	10
	60-74 tahun	5	50
	75-90 tahun	3	30
	> 90 tahun	1	10
3	Lama Menderita Hipertensi :		
	< 1 bulan	0	0
	1-6 bulan	0	0
	7-12 bulan	0	0
	> 1 tahun	10	100
4	Cara Mengatasi Hipertensi :		
	Pola hidup sehat	0	0
	Pola makan mengurangi konsumsi garam	0	0
	Mengkonsumsi Obat-obatan	10	100
	Tidak tahu (tidak memperdulikan penyakit)	0	0

Dari tabel 2. diatas, sebagian besar responden adalah perempuan yaitu sebanyak 7 responden (70%), setengah responden berusia 60-74 tahun yaitu sebanyak 5 responden (50%), seluruhnya menderita hipertensi > 1 tahun sebanyak 10 responden (100%), dan cara mengatasi hipertensi yaitu 100% dengan cara minum obat-obatan.

3. Tekanan Darah Sebelum Senam *Tai Chi*

	Kelompok Eksperimen		Kelompok Kontrol	
	TDS Pre Test	TDD Pre Test	TDS Pre Test	TDD Pre Test
Mean	147	93	151	92
Nilai Maksimum	160	100	160	100
Nilai Minimum	140	80	140	80
Standard Deviasi	8,23	6,74	8,75	7,88
N	10	10	10	10

Pada Kelompok eksperimen, menunjukkan bahwa nilai rerata tekanan darah sistolik yaitu sebesar 147 mmHg dengan standart deviasi 8,23 mmHg, rerata tekanan darah diastolik adalah 93 mmHg dengan standart deviasi 6,74 mmHg. Sedangkan pada kelompok kontrol, menunjukkan bahwa nilai rerata tekanan darah sistolik yaitu sebesar 151 mmHg dengan standart deviasi 8,75 mmHg, rerata tekanan darah diastolik adalah 92 mmHg dengan standart

deviasi 7,88 mmHg.

4. Tekanan Darah Setelah Senam *Tai Chi*

	Kelompok Eksperimen		Kelompok Kontrol	
	TDS Post Test	TDD Post Test	TDS Post Test	TDD Post Test
Mean	136	84	144	90
Nilai Maksimum	140	100	160	100
Nilai Minimum	160	80	130	80
Standard Deviasi	6,58	6,99	8,43	8,16
N	10	10	10	10

Pada kelompok eksperimen, menunjukkan bahwa nilai rerata tekanan darah sistolik yaitu sebesar 136 mmHg dengan standart deviasi 6,58 mmHg, rerata tekanan darah diastolik adalah 84 mmHg dengan standart deviasi 6,99 mmHg. Sedangkan pada kelompok Kontrol, menunjukkan bahwa nilai rerata tekanan darah sistolik yaitu sebesar 144 mmHg dengan standart deviasi 8,43 mmHg, rerata tekanan darah diastolik adalah 90 mmHg dengan standart deviasi 8,16 mmHg.

5. Pengaruh Senam *Tai Chi* Terhadap Perubahan Tekanan Darah

	Kelompok Eksperimen	
	Perub TDS Pre-Post	Perub TDD Pre-Post
Mean	-11	-9
Nilai Maksimum	0,00	0,00
Nilai Minimum	-20	-20
Standard Deviasi	6,99	7,37
N	10	10
Uji Wilcoxon		
	TDS – Post Eksperimen – TDS Pre Eksperimen	TDD – Post Eksperimen – TDD Pre Eksperimen
Z	-2.701[a]	-2.460[a]
Asymp. Sig. (2-tailed)	.007	.014

Pada kelompok eksperimen, menunjukkan bahwa nilai rerata perubahan tekanan darah sistolik yaitu sebesar -11 mmHg dengan standart deviasi 6,99 mmHg, rerata tekanan darah diastolik adalah -9 mmHg dengan standart deviasi 7,37 mmHg. Dari hasil uji *Wilcoxon* didapatkan nilai signifikasi tekanan darah sistolik *pre-post* pada kelompok eksperimen sebesar 0,007 dan tekanan darah diastolik *pre-post* pada kelompok eksperimen sebesar 0,014.

PEMBAHASAN

1. Hasil Pengukuran Tekanan Darah Sebelum Senam *Tai Chi*

Nilai mean (rerata) tekanan darah pada kelompok eksperimen sebelum di berikan intervensi di dapatkan tekanan darah sistolik yaitu sebesar 147 mmHg, rerata tekanan darah diastolik adalah 93 mmHg. Sedangkan nilai mean (rerata) tekanan darah pada kelompok kontrol di dapatkan tekanan darah sistolik yaitu sebesar 151 mmHg, rerata tekanan darah diastolik adalah 92 mmHg. Variasi tersebut dapat dipengaruhi oleh beberapa faktor diantaranya adalah genetik, stress lingkungan, jenis kelamin, usia, gaya hidup yang kurang sehat dan obat-obatan (Sutanto, 2010). Dengan faktor-faktor tersebut tekanan darah pada seseorang antara yang satu dengan yang lainnya tidak sama. Menurut Asyiyah (2009) Tekanan darah cendrung meningkat seiring bertambahnya usia, terjadinya peningkatan tekanan darah ini dipengaruhi oleh pelebaran pembuluh darah serta hilangnya elastisitas jaringan seiring dengan bertambahnya usia sehingga semakin tua seseorang resiko terjadinya hipertensi akan

semakin meningkat.

Berdasarkan penelitian yang telah dilakukan, menunjukkan bahwa pada kelompok eksperimen maupun kelompok kontrol setengahnya berusia 75 - 95 tahun sebanyak 10 responden (100%). Tekanan darah cenderung meningkat seiring bertambahnya usia. Ternyata angka kejadian hipertensi meningkat dengan bertambahnya usia. Terjadinya peningkatan tekanan darah ini dipengaruhi oleh pelebaran pembuluh darah serta hilangnya elastisitas jaringan seiring dengan bertambahnya usia sehingga semakin tua seseorang resiko terjadinya hipertensi akan semakin meningkat. Selama ini penanganan hipertensi di Panti Werdha hanya di berikan terapi farmakologi saja, pengobatan dengan farmakologi saja masih kurang efektif selama pemberian terapi hipertensi, oleh karena itu penanganan hipertensi selain dengan terapi pengobatan juga harus didukung dengan terapi non farmakologi diantaranya dengan senam *Tai Chi*, sehingga penanganan bisa lebih efektif.

2. Hasil Pengukuran Tekanan Darah Setelah Senam *Tai Chi*

Nilai mean (rerata) tekanan darah pada kelompok eksperimen setelah di berikan intervensi di dapatkan tekanan darah sistolik yaitu sebesar 136 mmHg, rerata tekanan darah diastolik adalah 84 mmHg. Sedangkan nilai mean (rerata) tekanan darah pada kelompok kontrol di dapatkan tekanan darah sistolik yaitu sebesar 144 mmHg, rerata tekanan darah diastolik, adalah 90 mmHg. Senam *Tai Chi* adalah olah raga tradisional Cina dengan gerakan lambat, pernafasan yang dalam, dan pemusatan pikiran dengan unsur meditasi. Senam *Tai Chi* dikenal dapat membantu mengendalikan stress yang merupakan salah satu faktor risiko hipertensi dengan cara latihan pernafasan yang tepat dikombinasikan dengan latihan otot ringan sehingga membuat seseorang menjadi rileks. Teknik pernafasan yang dalam dan gerakan yang lambat dapat meningkatkan konsentrasi oksigen di dalam darah, memperlancar aliran darah, dan menurunkan denyut jantung (Istifa, 2011).

Berdasarkan hasil penelitian terdapat seorang responden yang tidak mengalami penurunan tekanan darah baik tekanan sistolik maupun diastoliknya. Berdasarkan teori bahwa senam *Tai Chi* dapat menurunkan tekanan darah apabila dilakukan 3 kali seminggu selama 1 bulan, karena senam *Tai Chi* dapat menurunkan aktivitas saraf simpatis yang membawa dampak positif pada jantung (berupa denyut jantung yang stabil dan tekanan darah turun menuju normal). Ini karena aktivitas saraf simpatis dan parasimpatis menjadi seimbang dan harmonis. Sedangkan responden tersebut tidak mengikuti senam *Tai Chi* selama 2 kali dalam 1 bulan dan selama mengikuti senam *Tai Chi* responden menampakkan sikap tidak kooperatif, jadi tidak terjadi penurunan tekanan darah baik sistolik maupun diastoliknya.

3. Analisa Pengaruh Senam *Tai Chi* terhadap perubahan tekanan darah.

Pada kelompok eksperimen, menunjukkan bahwa nilai rerata perubahan tekanan darah sistolik yaitu sebesar -11 mmHg dengan standart deviasi 6,99 mmHg, tekanan darah diastolik, nilai rerata adalah -9 mmHg dengan standart deviasi 7,37 mmHg. Dari hasil uji *Wilcoxon* didapatkan nilai signifikasi tekanan darah sistolik *pre-post* pada kelompok eksperimen sebesar 0,007 dan tekanan darah diastolik *pre–post* pada kelompok eksperimen sebesar 0,014.

Dari hasil penelitian menunjukkan bahwa terjadi penurunan tekanan darah baik sistolik maupun diastolik. Adanya penurunan tekanan darah dikarenakan pada kelompok perlakuan di berikan senam *Tai Chi*, dengan senam *Tai Chi* dapat membantu mengendalikan stres yang merupakan salah satu faktor risiko hipertensi dengan cara latihan pernafasan yang tepat dikombinasikan dengan latihan otot ringan sehingga membuat seseorang menjadi rileks. Teknik pernafasan dalam dan gerakan yang lambat dapat meningkatkan konsentrasi oksigen di dalam darah, memperlancar aliran darah, dan menurunkan denyut jantung. Gerakan *Tai Chi* yang meliputi *body-mind-soul-breath* secara teratur terbukti dapat meningkatkan pelepasan nonadrenalin melalui urin, menurunkan kadar cortisol, serta menurunkan aktivitas saraf simpatis yang membawa dampak positif pada jantung (berupa denyut jantung yang stabil dan tekanan darah turun menuju normal).

Ini karena aktivitas saraf simpatis dan parasimpatis menjadi seimbang dan harmonis. Latihan tersebut dapat pula meningkatkan antioksidan untuk menghilangkan radikal bebas dalam tubuh dan menstabilkan tekanan darah (Sutanto,2013).

Senam *Tai Chi* merupakan salah satu bentuk cara untuk menurunkan tekanan darah pada lansia yang menderita hipertensi, karena dengan senam *Tai Chi* secara rutin dapat menjadikan otot rileks dan mengurangi stress sehingga menurunkan produksi hormone katekolamin dan kortisol serta dapat menurunkan produksi renin dan angiostensin yang merupakan faktor utama pemicu terjadinya hipertensi. Dengan gerakan yang lembut dari *Tai Chi* dapat menjadi pilihan olahraga yang baik terutama pada lansia. Senam *Tai Chi* juga merupakan bentuk terapi pengobatan hipertensi yang aman, efektif, dan tanpa efek samping.

SIMPULAN

1. Nilai rerata *pre-test* pada kelompok eksperimen di dapatkan tekanan darah sistolik sebesar 147 mmHg, pada rerata tekanan darah diastolik sebesar 93 mmHg. Sedangkan kelompok kontrol di dapatkan rerata tekanan darah sistolik sebesar 151 mmHg, dan rerata pada tekanan darah diastolik sebesar 92 mmHg.
2. Nilai rerata *post-test* pada kelompok eksperimen di dapatkan tekanan darah sistolik sebesar 136 mmHg, pada rerata tekanan darah diastolik sebesar 84 mmHg. Sedangkan kelompok kontrol di dapatkan rerata tekanan darah sistolik sebesar 144 mmHg, dan rerata pada tekanan darah diastolik sebesar 90 mmHg.
3. Ada pengaruh senam *Tai Chi* terhadap penurunan tekanan darah pada lansia hipertensi. Didapatkan nilai signifikasi uji *wilcoxon* pada tekanan darah sistolik pre-post pada kelompok eksperimen sebesar 0,007 dan tekanan darah diastolik pre-post kelompok eksperimen sebesar 0,014.

SARAN

1. Bagi petugas UPT Panti Werdha Mojopahit perlu melaksanakan kegiatan senam *Tai Chi* selama 3 kali dalam seminggu oleh instrukstur yang berkompeten dalam memberikan terapi pada lansia yang menderita hipertensi sebagai pendamping terapi farmakologi.
2. Perlu dilakukan penelitian lebih lanjut dengan melibatkan subyek yang lebih banyak dan pengaruh senam *Tai Chi* terhadap masalah-masalah kesehatan selain hipertensi.
3. Lansia perlu melakukan senam *Tai Chi* sebagai terapi non farmakologi, agar tidak ketergantungan terhadap obat-obatan farmakologi.
4. Untuk peneliti selanjutnya supaya menyertakan lansia dalam setiap kegiatan sehingga kehadiran lansia bisa 100%.

DAFTAR PUSTAKA

Anggraini, A.D. (2009). *Faktor-Faktor Yang Berhubungan Dengan Kejadian Hipertensi Pada Pasien Yang Berobat Di Poliklinik Dewasa Puskesmas Bangkinang Periode Januari Sampai Juni 2008*. Riau : Fakultas Kedokteran Universitas Riau. (Diakses tanggal 20 November 2014).

Arjatmo T, Hendra U. (2001). *Ilmu Penyakit Dalam. Jakarta:* Balai Penerbit FKUI.

Azizah, L. M. (2011). *Keperawatan Lanjut Usia*. Yogyakarta : Graha Ilmu.

Bare BG., Smeltzer SC. (2001). *Buku Ajar Keperawatan Medikal Bedah*. Jakarta : EGC

Brunner, Suddarth. (2006). *Keperawatan Medikal Bedah Vol 2*. Jakarta : EGC.

Christensen, B. (2006). *Adult Health Nursing. 3rd. Edition*. Philadelphia: mosby

Darmojo, Boedhi dan Martono. (2006). *Geriatri.* Edisi 3. Jakarta: Balai Penerbit Fakultas Kedokteran Universitas Indonesia (FKUI)

Elsanti, S. (2009). *Hidup Sehat Bebas Kolesterol, Stroke, Hipertensi & Serangan Jantung*. Yogyakarta : Araska.

Gardner, Samuel. (2007). *Panduan Sehat*

Mengatasi Tekanan Darah Tinggi. Jakarta : Prestasi Pustakaraya

Goldsten, John. (1997). *Sirkulasi dalam Konteks Mobilitas Total di Asia Tenggara.* Yogyakarta : Pusat Penelitian dan Studi Kependudukan Universitas Gajah Mada

Guyton, Arthur C Hall, John E. (2007). *Buku Ajar Fisiologi Kedokteran Edisi 11.* Jakarta : EGC

Hadibroto Iwan, Syamsir Alam. (2006). *Pengobatan Alternatif dan Komplementer.* Jakarta : PT Bhuana Ilmu Populer.

Hanns Peter, W. (2009). *Hipertensi.* Diterjemahkan oleh Lily Endang Joelani. Jakarta : PT Bhuana Ilmu Populer.

Kuntjoro, H . (2002). *Dukungan Sosial pada Lansia.* Di buka pada website http://www.e-psikologi.com (Diakses tanggal 20 November 2014)

Lanny Sustrani dkk. (2004). *Hipertensi.* Jakarta: Gramedia Pustaka Utama.

Mansjoer, Arif, dkk. (2001). *Kapita Selekta Kedokteran Edisi Ketiga Jilid 2.* Jakarta: FKUI.

Marliani L, S Tantan. (2007). *100 Questions & Answer Hipertensi.* Jakarta: Elex Media Komputindo.

Mubarak, W. I. (2007) *Promosi Kesehatan.* Jogyakarta : Graha Ilmu.

Muhammadun. (2013). *Hidup Bersama Hipertensi : Seringai Darah Tinggi Sang Pembunuh Sekejap.* Yogyakarta : In Books

Muttaqin, A. (2009). *Pengantar Asuhan Keperawatan Klien dengan Gangguan Sistem Kardiovaskuler.* Jakarta: Salemba Medika.

Nugroho, W. (2008). *Keperawatan Gerontik & Geriatrik, Ed.3.* Jakarta: EGC.

Potter, P.A., Perry, A.G. (2005). *Buku Ajar Fundamental Keperawanan : Konsep. Proses dan Praktik Ed. 4, Vol.2.* Diterjemahkan oleh Renata Komalasari dkk. Jakarta : EGC

Pudjiastuti, Sri Surini. (2003). *Fisioterapi Pada Lansia.* Jakarta : EGC.

Puspita W.R. (2009). *Gaya hidup pada mahasiswa penderita hipertensi [skripsi].* Surakarta: Fakultas Psikologi, Universitas Muhammadiyah Surakarta. (Diakses tanggal 17 November 2014).

Rahyani. (2007). *Faktor Yang Mempengaruhi Kejadian Hipertensi Pada Pasien Yang berobat dipoliklinik dewasa puskesmas Bangking Periode Januari-Juni 2007.* Sumatra Utara : USU (Diakses tanggal 10 November 2014).

Riskesdas. (2013). Data Depkes. Http://www.riskesdas.go.id (Diakses tanggal 10 November 2014).

Ritu Jain. (2011). *Pengobatan Alternatif untuk Mengatasi Tekanan Darah.* Jakarta : Gramedia.

Rohaendi. (2003). *Hipertensi dan Faktor Resiko.* Sumatera Utara : USU

Rokhaeni, H. (2001). *Buku Ajar Keperawatan Kardiovaskuler.* Jakarta : Bidang Diklat RS

Rusdi (2009). *Awas! Bisa mati cepat akibat Hipertensi dan Diabetes.* Jogjakarta : Power Books (IHDINA)

Santoso, Djoko. (2010) . *Membonsai Hipertensi.* Surabaya : Jaring pena

Suheni Y. (2007). *Hubungan antara kebiasaan merokok dengan kejadian hipertensi pada laki-laki usia 40 tahun ke atas di badan Rumah Sakit Daerah Cepu [skripsi].* Semarang: Fakultas Ilmu Keolahragaan, Universitas Negeri Semarang. (Diakses tanggal 24 November 2014)

Suroto. (2004). *Pengertian Senam, Manfaat Senam dan Urutan Gerakan,* Unit Pelaksana Teknis Mata Kuliah Umum Olahraga Fakultas Diponegoro, Semarang.

Sustrani, L. (2005). *Informasi Lengkap Untuk Lansia Hipertensi*. Jakarta : Pustaka Utama.

Sutanto, Jusuf. (2013). *The Dancing Leader 3.0 Tai Chi untuk Perawat Membangun Keluarga dan Rumah Sakit*. Jakarta : PT Kompas Media Nusantara.

Tortora, G. J, and N. P. Anagnostakos. (1990). *Principle Of Anatomy and Phisiologi*, 6tahun ed., Harper and Row Publ., New York, 120

Wahdah Nurul. (2011). *Menaklukkan Hipertensi dan Diabetes*. Yogyakarta : Multi Press.

Wolff, Hanns P. (2008). *Hipertensi*. Jakarta PT Buana Ilmu Populer

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Effects of Tai Chi Exercise Program Incorporating Laughter Therapy on Blood Pressure, Stress Response and Depression in Older People with Hypertension

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Abstract

The purpose of this study was to apply a Tai chi Exercise applying Laughter Therapy program as an intervention in consideration of physical activities and psychological factors to hypertensive elderly and examine its effects on systolic blood pressure, diastolic blood pressure, stress response and depression. The Tai chi Exercise applying Laughter Therapy applied in this study combined the Tai Chi exercise program consisting of 21 motions including the Sun style and Yang style developed by Lam(2006) and a laughter therapy developed for hypertension patients by the present researcher. The Program consisted of a total of 16 sessions, 2 session a week, and 90 minutes per session. In each session, This study used the nonequivalent control group pre - posttest design. In order to evaluate the effect of the Tai chi Exercise applying Laughter Therapy was measured by taking systolic blood pressure, diastolic blood pressure, stress response inventory (symptom of stress) and the Geriatric Depression Scale-Short Form (GDSSF-K) at baseline and after 8weeks, respectively. A Total of 74 subjects(38 in the experimental group and 36 in the control group) completed the study. From these results, it was found that the Tai chi Exercise applying Laughter Therapy is effective in blood pressure control and stress management for hypertensive elderly. Thus, nurses in the nursing intervention may utilize the program as a valuable intervention for hypertensive elderly.

Keywords: *Tai chi applying Laughter Therapy, Hypertensive Elderly, Blood pressure, Stress response, Depression*

1. Introduction

As of 2009, the prevalence rate of hypertension among Korean adults ages 30 or older was 27.9% among older people aged 65 and older was 55.7% while rates of hypertension treatment and control were low. For this reason, managing hypertension has become an important goal of the nation's health policy. Hypertension is the most contributing factor for the morbidity and mortality rates of cerebrovascular and heart diseases. Improved hypertension treatment and control rates could greatly contribute to diminishing incidence of cardiovascular disease.

However, more than 95 percent of hypertensive patients have essential hypertension that has no identifiable cause. The important contributing factors for hypertension are known to

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include unhealthy lifestyles such as alcohol consumption, smoking, inadequate dietary intake, insufficient physical activity as well as hereditary factors. Regular physical activity may control blood pressure; regular light-to- moderate aerobic exercise could lower systolic blood pressure and cholesterol levels in the bloodstream, reducing the mortality rate associated with complications.

Light-to-moderate exercise, especially aerobic exercise, has been shown to be effective at reducing blood pressure. Also, patients should have easy access to exercise programs in terms of time and cost. Psychological factors such as stress and depression affect blood pressure directly or indirectly as well as healthy lifestyles and treatment compliance, leading to noncompliance with lifestyle modifications such as drug therapy and exercise. As a result, such factors can worsen hypertension. Thus, we need a comprehensive nursing intervention strategy taking into account exercise and psychological factors such as stress and depression to manage hypertension in the community.

Tai Chi exercises among workout programs for hypertensive patients is a light-to-moderate aerobic exercise and easy to follow; it requires no particular equipment, facility, or attire; it is not bounded by the weather or locations; it can be performed in a narrow space either individually or in a group setting. For these reasons, it is supposed to be good for older patients with hypertension. However, few previous studies of the effect of Tai Chi exercises on hypertensive patients have been conducted to determine socio-psychological effects. Prior research of older people reported high dropout rates and a loss of interest in Tai Chi exercise programs due to lack of confidence in learning Tai Chi movements. Therefore, we need a strategy aimed at overcoming these problems. In recent years, as the link between laughter and health has become known, laughter therapy has been getting a lot of attention as a new complementary and alternative therapy; it reduces negative cognitive responses, mitigates depression and stress, decreases sympathetic nerve activity, and relaxes blood vessels, leading to a drop in blood pressure.

We need a comprehensive nursing intervention strategy taking into account psychological factors as well as physical activities such as exercise to manage hypertension. A Tai Chi exercise program incorporating laughter therapy for older people with hypertension could mitigate psychological effects such as stress and depression, strengthening the exercise effect of Tai Chi and improving mutual dynamics among patients and piquing interest a program that could address high dropout rates and a loss of interest considered problems in previous research.

2. Purpose of the study

This study examines the effect of a Tai Chi exercise program incorporating laughter therapy on older people with hypertension and then determines the effect of Tai Chi exercise on their blood pressure, stress response, and depression. The results of this study will be used as a nursing intervention for older people with hypertension.

3. Hypotheses

Sixteen Tai Chi exercise sessions incorporating laughter therapy for older people with hypertension were held twice a week for eight weeks. Hypotheses to test their effects were as follows:

Hypothesis 1: Those in the experimental group participating in a Tai Chi exercise program incorporating laughter therapy are more likely to have lower blood pressure than are those in the control group.

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Hypothesis 2: Those in the experimental group participating in a Tai Chi exercise program incorporating laughter therapy are more likely to experience fewer stress responses than are those in the control group.

Hypothesis 3: Those in the experimental group participating in a Tai Chi exercise program incorporating laughter therapy are more likely to experience less depression than are those in the control group.

4. Methods

4.1. Research design

This study uses a pretest-posttest nonequivalent control group design. It is a quasi-experiment to determine the effect of 8-week Tai Chi exercise sessions incorporating laughter therapy on blood pressure, stress responses, and depression in hypertensive patients (Figure1).

Group	Pre- Test	Intervention	Post- Test
Experimental Group	E1	X	E2
Control Group	C1		C2

E1: Blood pressure, stress response, depression
E2: Blood pressure, stress response, depression
X: Tai-Chi Exercise applying Laughter Therapy (8weeks)
C1: Blood pressure, stress response, depression
C2: Blood pressure, stress response, depression

Figure 1. Research design

4.2. Study participants

The participants consisted of patients aged 60 and older who were receiving follow-up care from a public health center in the city of Gwangju after getting a diagnosis of essential hypertension. Among them, those who were eligible for participation in this study and who wanted to participate in a Tai Chi exercise program incorporating laughter therapy were assigned to the experimental group, while those who wanted to fill out only questionnaires and have their blood pressure measured were assigned to the control group.

To be eligible for this study, (1) the individual must understand the purpose of the study and submit written informed consent to participate in this study; (2) the individual must have no history of complications of hypertension; and (3) the individual must have no experience of participating in regular exercise programs in the last six months.

The sample size for this study was calculated using G*Power according to ahaCohen's formular (1988), which is used to determine sample sizes needed when comparing more than two means. Sample sizes needed for a significance level of 0.05, an effect size of 0.6, and a statistical power of 0.8 were 72 people; however, 25% of dropout rates were expected from previous research and pre-test. As a result, the experimental and control group alike were given 44 people. Six people in the experimental group were excluded for the following

reasons: 2 were absent three times or more, 1 changed drug dosages, 1 was hospitalized for diseases other than hypertension, and 2 moved to another area. As a result, 38 people remained in the experimental group. Eight people in the control group were excluded for the

following reasons: 5 declined participation in the program and not responded to posttest measurement, 2 changed types of drugs, and 1 was hospitalized for diseases other than hypertension. As a result, 36 people remained in the control group (Figure 3).

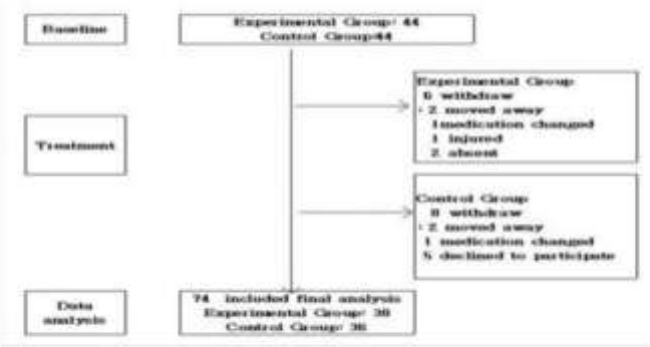

Figure 2. Participant flow sheet

4.3. Research instruments

4.3.1. Stress response: This study used the instrument for stress response that was translated into Korean by Lee (1992). It is a self-report instrument, consisting of 94 items. Each item was rated on a five-point scale. The higher the score, the stronger the stress response. As for the reliability of the instrument, Cronbach's α for this study was .96, while Cronbach's α for Lee's study (1992) was .97.

4.3.2. Depression: This study used the instrument adapted to the needs of older people in Korea from the 15-item condensed version of the Geriatric Depression Scale developed by Sheikh & Yesavage (1986). Each item consisted of questions asking for a Yes/No. One point was assigned for each item; scores ranged from 0 to 15. The higher the score, the more severe the depression. A total score of 5 or higher was defined as depression. Cronbach's α for this study was .73.

4.3.3. Blood pressure measurement: Blood pressure was measured using a blood pressure monitor. The participants was asked to sit and rest in a chair for five minutes or so and then place their upper arm at the same height as the heart with the palm of their hand facing up to have their blood pressure checked. Two readings were taken five minutes apart; the mean value of the two readings was obtained.

4.4. Research Process

4.4.1. Participant Recruitment for Research: Approval to conduct this study was obtained from the institutional review board at the nursing college of Seoul National University. The purpose of the study, the plan for the study, questionnaires and the like were explained to a person in charge of chronic disease working at a public health center in the city of Gwangju. Study participants eligible for inclusion criteria were recruited. For the

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experimental group, a nurse in charge of chronic disease confirmed the participants' intent to participate in the program by calling them before obtaining written informed consent; those who did not want to participate in the program among those eligible for inclusion criteria were assigned to the control group.

4.4.2. Data Collection

1) **Measurement before intervention:** Blood pressure, stress response, and levels of depression in the experimental and control group were measured before intervention. When filling out written informed consent and a questionnaire, the participants read the content of the two forms and completed the two forms for themselves. When they could not read the content of the two forms for themselves, however, a research assistant read the instructions and content to them and filled out the two forms based on their responses.
2) **Intervention program for the experimental group:** A 90-minute Tai Chi exercise program incorporating laughter therapy was provided twice a week(Monday and Thursday) for eight weeks. During the intervention period, they had their blood pressure checked before/after each intervention. When having their blood pressure checked at each intervention, they were asked to sit and rest in a chair for at least five minute. Two readings were taken five minutes apart; the mean value of the two readings was used. When having their blood pressure measured, they were asked about changes in medication-taking behavior, changes in their exercise and health; any changes were excluded from the study. In particular, we checked changes in types and volumes of their medications through their prescriptions.
3) **Measurement shortly after intervention:** After eight weeks of interventions (16 sessions), the participants had their blood pressure, stress response, and levels of depression checked in the same way as in measurement before intervention. Those in the control group visited the public health center the next day after intervention and had their blood pressure, stress response, and levels of depression checked in the same way as in measurement before intervention

4.5. Data analysis

Collected data were analyzed using SPSS WIN 19.0. Because all data from each group were normally distributed, a parametric test was used. Real number and percentage were calculated for participants' general and disease-related characteristics. To test homogeneity of the experimental and control group, χ^2- test and t-test were used. The reliability of the measurement instrument was tested using Cronbach's α. Systolic and diastolic blood pressure, stress responses, and levels of depression in the experimental and control group were analyzed using t-test and ANCOVA.

5. Results

5.1. Participants' general characteristics and homogeneity test

The results of the pre-test for homogeneity of the experimental and control group showed that the experimental group and the control group were homogeneous in terms of all items, with the exclusion of the sexes (Table 1). Because the pre-test for homogeneity of the experimental and control group showed that the sexes were not homogeneous, ANCOVA

was performed using the sexes as a covariate. Because a significance level of the sexes was greater than a significance level of .05, the sexes did not affect dependence variables at all.

5.2. Participants' disease-related characteristics and homogeneity test

The results of the pre-test for homogeneity of hypertension-related characteristics between the two groups showed that the two groups were homogeneous in terms of all items (Table 2).

5.3. Pre-test for homogeneity of result variables

The results of the pre-test for homogeneity of main variables showed that no statistically significant differences between the two groups were found in systolic and diastolic blood pressure, severity of stress, and depression, showing that the two groups were homogeneous (Table 3).

Table 1. Homogeneity test of sociodemographic characteristics

Characteristics	Categories	Experimental group(n=18) n(%) Mean±SD	Control group(n=18) n(%) Mean±SD	χ^2 or t	p
Age(yr)	80-85	3(7.9)	4(11.1)		
	66-75	29(76.3)	18(50.0)		
	76-85	6(15.8)	14(38.9)		
		71.24±6.07	74.06±6.82	1.809	.080
Sex	Female	36(94.7)	24(66.7)	8.496	.002
	Male	2(5.3)	12(33.3)		
Marital status	Single	0(0.00)	1(2.8)	2.881	.410
	Married	16(42.1)	19(52.8)		
	Widowed	21(55.3)	16(44.4)		
	Divorce	1(2.6)	0(0.00)		
Education	Uneducated	9(23.7)	5(13.9)	3.343	.302
	Elementary school	12(31.6)	17(47.2)		
	Middle school	8(21.1)	9(25.0)		
	High school	8(21.1)	4(11.1)		
	above College	1(2.6)	1(2.8)		
Employment status	Yes	2(5.3)	4(11.1)	.849	.424
	No	36(94.7)	32(88.9)		
Economic status	High	0(0.00)	0(0.00)	.000	.592
	Middle	19(50.0)	18(50.0)		
	Low	19(50.0)	18(50.0)		
Religion	Yes	32(84.2)	23(63.9)	4.001	.083
	No	6(15.8)	13(36.1)		

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Table 2. Homogeneity test of disease-related characteristics

Characteristics	Categories	Experimental group(n=38) n(%) Mean±SD	Control group(n=36) n(%) Mean±SD	X^2 or t	p
Years since hypertension (yr)		7.76±8.06	7.06±5.78	-.432	.667
Smoking	Yes	2(5.3)	2(5.6)	.003	.672
	No	36(94.7)	34(94.4)		
Drinking	Yes	6(15.8)	10(27.8)	1.568	.264
	No	32(84.2)	26(72.2)		
Exercise	Regularly	24(63.2)	20(55.6)	.850	.654
	Irregularly	9(23.7)	12(33.3)		
	No	5(13.2)	4(11.1)		
Experience of admission due to hypertension	Yes	4(10.5)	7(19.4)	1.162	.281
	No	34(89.5)	29(80.6)		
Medication	Yes	29(76.3)	31(86.1)	1.156	.282
	No	9(23.7)	5(13.9)		

Table 3. Homogeneity test of Dependent Variables

variables	Experimental group(n=38)	Control group (n=36)	t	p
SBP(mmHg)	143.68± 8.83	139.72 ± 11.08	-1.708	.092
DBP(mmHg)	85.26± 8.62	83.33 ± 8.33	-1.102	.274
Stress response(total)	84.34±32.71	83.02 ± 36.43	-1.828	.072
Peripheral manifestations	.72 ± .61	.67 ± .62	-.437	.663
Cardiopulmonary symptom	.94 ± .87	.72 ± .69	-1.028	.038
Central neurological symptom	.89 ± .78	.68 ± .67	-1.975	.052
Gastro- intestinal symptom	.72 ± .84	.58 ± .68	-1.217	.227
Muscle tension	.89 ± .69	.83 ± .56	-1.789	.078
Habitual patterns	.82 ± .58	.78 ± .58	-.479	.633
Depression	.83 ± .90	.83 ± .83	-.509	.612
Anxiety/ Fear	1.12± .71	.85 ± .69	-1.839	.070
Emotional irritability	.77 ±.72	.59 ± .54	-1.343	.183
Cognitive disorganization	1.05±.80	.88 ± .76	-.882	.381
Depression	5.48 ± 3.57	5.17 ± 2.71	-.381	.704

SBP: Systolic Blood pressure
DBP: Diastolic Blood pressure

5.4. Hypothesis testing

The experimental group had a systolic blood pressure of 143.68mmHg before intervention and 124.74mmHg after intervention; the control group had a systolic blood pressure of 139.72mmHg before intervention and 141.67mmHg after intervention. Because the experimental group had a significantly lower systolic blood pressure than the control group did, the first sub-hypothesis was supported.

The experimental group had a diastolic blood pressure of 85.26mmHg before intervention and 75.53mmHg after intervention; the control group had a diastolic blood pressure of 83.33mmHg before intervention and 82.78mmHg after intervention. Because the experimental group had a significantly lower diastolic blood pressure than the control group did, the second sub-hypothesis was supported.

The experimental group had stress response scores of 84.34 ± 52.71 before intervention and 73.11 ± 51.46 after intervention; the control group had stress response scores of 65.02 ± 36.43 before intervention and 76.19 ± 43.77 after intervention. Because the experimental group had a significantly lower stress response score than the control group did, the second hypothesis was supported.

The experimental group had a depression score of 5.48 before intervention and 4.63 after intervention; the control group had a depression score of 5.17 before intervention and 5.36 after intervention. Because there were no significant differences between the two groups, the third hypothesis was not supported.

6. Conclusions

The current study was conducted based on previous studies showing that the Tai Chi exercises did not lower blood pressure and reduce stress consistently and that combined several lifestyle modifications was more effective than one lifestyle modification alone to manage hypertension [7].

The hypothesis was supported that a Tai Chi exercise program incorporating laughter therapy is more likely to lower systolic and diastolic blood pressure in older people with hypertension. These results are line with those of a study looking at hypertensive patients who completed a six-week Tai Chi exercise program [6], and those of a study looking at hypertensive patients who saw their systolic and diastolic blood pressure decrease after completing a 12-week Tai Chi exercise program [2]. The findings of this study are also consistent with those of a study looking at older people with hypertension who saw their systolic and diastolic blood pressure decrease after completing a 4-week laughter therapy [11]. Compared with previous research looking at hypertensive patients who underwent either Tai Chi exercises or laughter therapy, this study suggests that Tai Chi exercises incorporating laughter therapy may be effective at reducing the activity of the sympathetic nervous system and stress [2]. In addition, it could be that laughter therapy increases the effects of reduced sympathetic nervous system activities by regulating the autonomic nervous system, leading to a noticeable drop in blood pressure. This study found that an 8-week Tai Chi exercise program incorporating laughter therapy led to a drop in stress response, depression, anxiety, cognitive stress symptoms among hypertensive patients.

These findings are not consistent with those of a study of hypertensive patients who saw no significant changes in cortisol after undergoing Tai Chi exercise [6], and those of a study of hypertensive patients who saw a little but not noticeable drop in their levels of stress after undergoing laughter therapy [11]. The results of this study are also inconsistent with those of a study of hypertensive patients who abdominal breathing technique did not lead to a noticeable drop in stress response. Therefore, this study suggests that Tai Chi exercises and laughter therapy reduce stress response among hypertensive patients, regulating blood pressure. Although depression scores were not significantly lowered after intervention in the current study, we classified levels of depression in the experimental and control groups as 'no depression', 'mild', 'moderate-to-severe', and 'severe' based on their depression scores and then analyzed the difference between the two groups. As a result, there were no

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differences in depression between the two groups before intervention (χ^2=2.572, p=.276), but there were significant differences in depression between the two groups after intervention (χ^2=7.845, p=.020). The number of participants with depression in the experimental group decreased to 11(28.9%) after intervention, down from 22(57.9%) before intervention , whereas the number of participants with depression in the control group increased to 24(71.7%) after intervention, up from 23(63.9%) before intervention—a proof that the Tai Chi exercise program incorporating laughter therapy contributed to decreased depression.

A Tai Chi exercise program incorporating laughter therapy for hypertensive patients can be used as a safe and low-cost independent nursing intervention program for nurses caring for older people. Given the low participation rates in existing Tai Chi exercise programs, it is worthwhile to note that a Tai Chi exercise program incorporating laughter therapy laid the basis for enabling increased participation in Tai Chi exercise programs.

References

[1] National health statistics (National food & nutrition statistics: based on 2009 Korea national health and nutrition examination survey), Department of Health and Human Services press, Seoul, **(2011)**.

[2] J.C. Tsai, W.H. Wang, P. Chan, L.J. Lin, C.H. Wang, B. Tomlinson, M.H. Hsieh, H.Y. Yang and J.C. Liu, "The beneficial effects of Tai Chi Chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial", Journal of Alternative Complimentary Medicine, Vol. 9, pp. 747-754, **(2003)**.

[3] S.U. Lee, "Effect of blood pressure improvement by lifestyle Modification program on hypertension patient", Kyung Hee University/dissertation, Seoul, **(2011)**.

[4] Joint National Committee, "The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure", Journal of the American Medical Association, Vol. 289, pp. 2560-2571, **(2003)**.

[5] M.W. Rogers, M.M. Probst, J.J. Gruber, R. Berger and J. Boone Jr., "Differential effects of exercise training intensity on blood pressure and cardiovascular responses to stress in borderline hypertension humans," Journal of Hypertension, Vol. 14, pp. 1369-1375, **(1996)**.

[6] E.N. Lee, "The Effects of Tai Chi Exercise Program on Blood Pressure, Total Cholesterol and Cortisol Level in Patients with Essential Hypertension," Journal of Korean Academy of Nursing, Vol. 34, No. 5, pp. 829-837, **(2004)**.

[7] S.A. Lee, " Association between stress an d blood pressure - Korea Health and Nutrition Survey in 1998", The Graduate School of Health Science and Management, Yonsei University /dissertation, Seoul, **(2001)**.

[8] D. Lucini, G. Di Fede, G. Parati and M. Pagani, "Impact of chronic psychosocial stress on autonomic cardiovascular regulation in otherwise healthy subject," Hypertension, Vol. 46, pp. 1202-1206, **(2005)**.

[9] H.M. Suh, S.J. Yoo and Y.S. Ha, "A Study on the Verification of the Profile of Soo's Elderly stress Scale (SESS)," Journal of Korean Academy of Nursing, Vol. 31, No. 1, pp. 94-106, **(2001)**.

[10] H.J. Hyun, "The effect of laughter therapy on the blood pressure, perceived stress and depression", Seoul National University/dissertation, Seoul, **(2010)**.

[11] P.S. Wang, R.L. Bohn, E. Knight, R.J. Glynn, H. Mogun and J. Avorn, "The Impact of Depressive Symptoms and Psychosocial Factors", Journal of General Internal Medicine, Vol. 17, No. 7, pp. 504-511, **(2002)**.

[12] Y.J. Park and I.H. Park, "The Effect of Tai chi Exercise in Elderly Women", Journal of Muscle and Joint Health, Vol. 15, No. 2, pp. 119-129, **(2008)**.

[13] I.O. Hwang, S.H. An and R.Y. Song, " Effect of 12-Week Tai Chi Exercise on Glucose Control, Peripheral Nerve Modulation, and Perceived Health for Type 2 Diabetic Patients with Neuropathy" , Journal of Muscle and Joint Health, Vol. 17, No. 1, pp. 35-46, **(2010)**.

[14] H.J. Bennett, "Humor in Medicine," Southern Medical Journal, Vol. 96, No. 12, pp. 257-1261, **(2003)**.

[15] K.S. Kim, J.A. Yu, J.A. Kim, L.S. Lee and I.O. Lee, "Effects of Tai-Chi Exercise and Self-help Management Program Applying Laughter Therapy in Patients with Osteoarthritis", Journal of Muscle and Joint Health, Vol. 17, No. 1, pp. 68-78, **(2010)**.

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Original Article

The effects of Tai Chi on waist circumference and blood pressure in the elderly

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Abstract. [Purpose] The purpose of this study was to investigate the effects of Tai Chi on waist circumference and blood pressure in the elderly. The present study used a nonequivalent control group pretest-posttest design. [Subjects and Methods] Sixty-eight elderly individuals residing in J city were divided into 2 groups: 34 in the experimental group, who received Tai Chi training for 6 weeks, and 34 in the control group, who did not receive Tai Chi training. Simplified Yang style 24-form Tai Chi was used as the intervention, which was conducted for 60 minutes per session, 5 sessions per week, for a total of 6 weeks. In each session, subjects in the experimental group conducted 10 minutes of warm-up exercises, 45 minutes of Tai Chi, and 5 minutes of cool-down exercises. Waist circumference and blood pressure were measured before and after the 6-week intervention. [Results] Waist circumference and blood pressure decreased significantly after the 6-week intervention in the experimental group compared with the control group. [Conclusion] Tai Chi can be used as an effective intervention to improve waist circumference and blood pressure in the elderly.

Key words: Blood pressure, Tai Chi, Waist circumference

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INTRODUCTION

Average life expectancy has increased owing to continued economic growth and advancements in medical science and technology, and, as such, the elderly population is increasing rapidly. According to a recent report, elderly individuals are less likely to receive medical treatment as they age, when their income is lower, and if they are female[1)], and the burden of medical costs is increasing accordingly.

In particular, because prevalence of metabolic syndrome is higher in those aged over 60 than in other age groups, it has been of clinical interest. In those with metabolic syndrome, risk of cardiovascular disease is increased by more than 2-fold, while risk of diabetes is increased by more than 10-fold[2, 3)].

Increasing prevalence of metabolic syndrome in older individuals has been reported to be closely related to low physical activity in the elderly[4)]. Among various risk factors for metabolic syndrome, high blood pressure has been found to be most significant, followed by abdominal obesity. Thus, in order to decrease prevalence of metabolic syndrome, factors that can decrease blood pressure and abdominal obesity should be investigated[5)].

Exercise—a factor influencing metabolic syndrome that can be regulated—is essential for maintaining health, recovering health from chronic disease, and maintaining independence in the elderly, and is reported to have positive physical, psychologic, and social influences[6)]. In a previous study regarding Tai Chi in middle-aged women, risk factors for metabolic syndrome decreased while health-related quality of life improved[7)]. Similarly, in a pilot study investigating Tai Chi in 11 middle-aged subjects with metabolic syndrome, waist circumference and blood pressure showed significant improvement compared with baseline values[8)].

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Therefore, the present study aimed to determine the effects of Tai Chi in the elderly, who show high prevalence of metabolic syndrome, and to investigate whether Tai Chi can be used actively in a clinical setting.

SUBJECTS AND METHODS

This study used a nonequivalent control group pretest-posttest quasi-experimental design. The sample size necessary for t-tests was calculated as 36 subjects in each group according to G* power analysis conducted with an effect size of 0.67, significance level of 0.05, and power of 0.80, based on the results of a previous study[6].

In the present study, 68 elderly individuals residing in J city were divided into 2 groups: 36 in the experimental group, who received Tai Chi training for 6 weeks, and 36 in the control group, who did not receive Tai Chi training. However, 2 subjects in each group withdrew, resulting in 34 subjects in each group. Subjects were assigned to groups using a coin-flip strategy. Subjects were aged over 65, had not exercised regularly during the last 6 months, had no health problems preventing them from exercising, and could perform physical activities independently. Subjects received an explanation regarding the purpose and methods of the study prior to participation and provided written informed consent according to the principles of the Declaration of Helsinki.

The intervention used in this study was Yang style 24-form Tai-Chi, which was conducted for 60 minutes per session, 5 sessions per week, for a total of 6 weeks. In each session, subjects in the experimental group conducted 10 minutes of warm-up exercises, 45 minutes of Tai Chi, and 5 minutes of cool-down exercises. Similar to the experimental group, the control group performed 10 minutes of warm-up exercises and 5 minutes of cool-down exercises in each session, 5 times per week, for a total of 6 weeks. The content validity of the program was verified by a medical specialist, nursing professor with experience conducting exercise-related research, and exercise therapist. The intervention was conducted at our organization's auditorium from 14:00 pm to 15:00 pm.

Waist circumference and blood pressure were measured before and after the 6-week intervention. Mean waist circumference was determined after measuring twice using a tape (Dritz), while blood pressure was measured using an automated sphygmomanometer (model BPBIO330, Meditec) on the subject's right arm after relaxing for 20 minutes. Data were collected between December 2, 2013, and February 24, 2014. After collecting data from the control group for 6 weeks, data from the experimental group were collected for 6 weeks.

Data were analyzed using SPSS version 19.0 for Windows (IBM Corporation). Homogeneity between the experimental and control groups was tested using χ^2 and t-tests. T and paired t-tests were performed to determine differences in waist circumference and blood pressure between groups. Statistical significance was set at $p<0.05$.

RESULTS

Subjects' mean age was 72.4 ± 3.8 years and 71.2 ± 5.1 years in the experimental and control groups, respectively.

Because there were no significant differences between groups in age, gender, marital status, educational level, religion, income, or exercise status, the groups were found to be homogeneous (Table 1).

Moreover, before the intervention, there were no significant differences between groups in waist circumference, systolic blood pressure (SBP), or diastolic blood pressure (DBP) (Table 2). After the intervention, waist circumference decreased by 1.8 cm in the experimental group and increased by 0.2 cm in the control group; change in waist circumference showed a significant difference between groups (p=0.001) (Table 3).

SBP decreased by 16.6 mmHg in the experimental group and increased by 0.8 mmHg in the control group; change in SBP showed a significant difference between groups (p=0.001) (Table 3).

DBP decreased by 10.1 mmHg in the experimental group and increased by 0.9 mmHg in the control group; change in DBP showed a significant difference between groups (p=0.001) (Table 3).

DISCUSSION

Tai Chi conducted in elderly individuals decreased the risk factors for metabolic syndrome, thus, showing positive effects. Change in waist circumference before and after the intervention showed a significant difference between the experimental and control groups. This finding is consistent with a previous study[10] reporting a significant difference in waist circumference after 24 weeks of exercise, and with another study[8] reporting an increase in oxygen consumption of 16.1% in the Tai Chi exercise group and a decrease of 1.8% in the control group after 1 year of Yang style Tai Chi exercise.

Regarding BP in the experimental group, before the Tai Chi intervention, values for SBP and DBP were higher than normal. After the intervention, however, SBP and DBP measured within normal ranges. On the contrary, in the control group, values for SBP and DBP were higher than normal both before and after the intervention. These results are similar to a previous study[5] showing that high BP contributed to prevalence of metabolic syndrome in middle-aged and elderly individuals living in one region. Our findings also agree with another study[7] in which 12 weeks of Tai Chi exercise conducted in middle-aged women with metabolic syndrome exerted significant effects on decreasing certain risk factors for metabolic syndrome (DBP, waist circumference) in the experimental group compared with the control group.

Table 1. Subjects' general characteristics

Characteristic		Experimental group (n = 34)	Control group (n = 34)
Age (yrs)		72.4 ± 3.8	71.2 ± 5.1
Gender	Male	11 (32.4)	10 (29.4)
	Female	23 (67.6)	24 (70.5)
Marital status	Married	23 (67.6)	26 (76.5)
	Other	11 (32.4)	8 (23.5)
Educational level	No school	5 (14.7)	4 (11.8)
	Elementary school	20 (58.8)	20 (58.8)
	Middle school	5 (14.7)	5 (14.7)
	High school	4 (11.8)	4 (11.8)
	College	0 (0)	1 (2.9)
Religion	Buddhist	13 (38.2)	11 (32.4)
	Christian	6 (17.6)	6 (17.6)
	Catholic	8 (23.5)	5 (14.7)
	Other	1 (2.9)	2 (5.9)
	No religion	6 (17.6)	10 (29.4)
Income, 10,000 won	≤50	4 (11.8)	9 (26.5)
	>50	15 (44.1)	14 (41.2)
	≥100	15 (44.1)	10 (29.4)
	≥200	0 (0)	1 (2.9)
Exercise	Yes	11 (32.4)	9 (26.5)
	No	23 (67.6)	25 (73.5)

Data are presented as mean ± SD or n (%), as appropriate.

Table 2. Dependent variables between groups

Variable	Experimental group (n = 34)	Control group (n = 34)
Waist circumference (cm)	82.6 ± 6.1	83.2 ± 6.6
Systolic blood pressure (mmHg)	149.3 ± 19.6	143.8 ± 22.8
Diastolic blood pressure (mmHg)	88.1 ± 16.6	86.6 ± 17.1

Data are presented as mean ± SD.

Table 3. Dependent variables before and after the intervention between groups

Variable		Before	After
Waist circumference (cm)	Experimental group	82.6 ± 6.1	80.8 ± 6.0**
	Control group	83.2 ± 6.6	83.4 ± 6.6
Systolic blood pressure (mmHg)	Experimental group	149.3 ± 19.6	132.7 ± 15.6**
	Control group	143.8 ± 22.8	144.7 ± 20.5
Diastolic blood pressure (mmHg)	Experimental group	88.1 ± 16.6	78.0 ± 11.4**
	Control group	86.6 ± 17.1	87.5 ± 13.9

Data are presented as mean ± SD, **p<0.01

In the present study in which the intervention was conducted for a relatively short period of time (6 weeks), significant differences in dependent variables, including waist circumference and BP, may have occurred because the exercise was conducted frequently (5 times per week). We applied Tai Chi exercise 5 times per week for a total of 6 weeks in elderly men and women and observed significant decreases in waist circumference and BP in the experimental group.

Thus, regular Tai Chi training has a positive impact on decreasing the risk factors for metabolic syndrome in the elderly.

The findings of this study suggest the need for further research to identify the effects on body mass index and blood-related indicators in the elderly.

REFERENCES

1) Ministry of Health, Welfare and Family Affairs: 2013 Korean National Health and Nutrition Examination Survey, 2014.
2) Park HS: Epidemiology of metabolic syndrome in Korea. J Korean Soc Stud Obes, 2002, 11: 203–211.
3) Ministry of Health, Welfare and Family Affairs: 2010 Korean National Health and Nutrition Examination Survey, 2011.
4) Berra K: Treatment options for patients with the metabolic syndrome. J Am Acad Nurse Pract, 2003, 15: 361–370. [Medline] [CrossRef]
5) Lee HS, Kwon CS: Prevalence of metabolic syndrome and related risk factors of elderly residents in Andong rural area. 1. Based on the anthropometric measurements and health behaviors. J Korean Soc Food Sci Nutr, 2010, 39: 511–517. [CrossRef]
6) Jeong YM, Kim JH: An effect of health promotion program on health behavior, perceived health status and life satisfaction in the elderly. J Korean Acad Adult Nurs, 2002, 14: 327–336.
7) Eom AY: The effects of the Tai Chi exercise on metabolic syndrome and health-related quality of life in middle-aged women. J Muscle Jt Health, 2012, 19: 152–160. [CrossRef]
8) Liu X, Miller YD, Burton NW, et al.: A preliminary study of the effects of Tai Chi and Qigong medical exercise on indicators of metabolic syndrome, glycaemic control, health-related quality of life, and psychological health in adults with elevated blood glucose. Br J Sports Med, 2010, 44: 704–709. [Medline] [CrossRef]
9) Taylor-Piliae RE, Haskell WL, Froelicher ES: Hemodynamic responses to a community-based Tai Chi exercise intervention in ethnic Chinese adults with cardiovascular disease risk factors. Eur J Cardiovasc Nurs, 2006, 5: 165–174. [Medline] [CrossRef]
10) Kim JS, Kim SY: The effect of Qigong-based combined exercise program for rural elderly people. J Korea Soc Wellness, 2012, 7: 39–51.

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Effect of Tai Chi exercise for hypertension: a meta-analysis of randomized controlled trials

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Abstract. Objectives: We designed this study to evaluate the effect of Tai Chi exercise for hypertension patients. Methods: RCTs designed to evaluate the effect of Tai Chi exercise for hypertension patients were searched from Science Direct, EBSCO, Pub Med, CNKI and Wanfang databases. Results: The meta-analysis found that (ATC) the SBP (WMD = 13.19 mmHg; 95%CI: 11.52 to 14.87; P < 0.0001) and DBP (WMD = 8.92 mmHg; 95% CI: 7.94 to 9.90; P< 0.0001) can be significantly reduced after Tai Chi exercise compared to before Tai Chi exercise (BTC). ATC significantly improved the content of NO (WMD =-7.98mmol/L; 95%CI: -10.63 to -5.33; P < 0.0001), and decreased the content of TG (WMD =0.22mmol/ml; 95%CI: 0.06 to 0.38; P =0.006) and LDL-C (WMD =0.20mmol/ml; 95%CI: 0.13 to 0.26; P < 0.0001). There was no obvious difference between ATC and BTC on HR (WMD = 1.64; 95%CI: -0.51 to 3.97; P =0.14), TC (WMD = -0.03mmol/ml; 95%CI: -0.22 to 0.17; P =0.80) and HDL-C (WMD =-0.04 mmol/ml; 95%CI: -0.09 to 0.01; P =0.13). Conclusions: As a valid treatment for hypertension patients, Tai Chi exercise can decrease SBP, DBP, TG, LDL-C and increase NO.

1 Introduction

Hypertension is observed as the most common disease in primary health care of human, severe complications can be leaded by this disease, such as atherosclerotic complications including stroke, hypertensive renal disease, and hypertensive cardiovascular disease, renal inadequacy, coronary artery disease, and even the cardiac failure[1,2]. The American Heart Association suggested that the risk of hypertension can be reduced by the effective lifestyle modifications like regular exercise[3]. Tai Chi was ancient martial arts in Oriental cultures has been used for centuries. It has also been used as an exercise form and best adapted for older individuals of Asian heritage, to enhance body awareness and body balance. Tai Chi can lowered diastolic blood pressure (DBP) and systolic blood pressure (SBP) has been proved by a recent of trials, modulated lipid metabolism, and raised the NO index of patients with hypertension, and others comprehensive beneficial effects[4-16]. Tai Chi can benefit hypertension patients which supported by increasing evidence from RCTs, but there is no strictly evaluated evidence to confirm its function in hypertension patients health according to small size individual studies samples were short of strictly designed large size and inconsistent results RCTs. Clearly, an up-to-date meta-analysis and systematic review of this topic is needed. Therefore, we designed this study to sum up the actual evidence on the curative effect of Tai Chi exercise for the

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therapy of hypertension patients.

2 Methods

2.1 Strategy of search

Two reviewers carried out a scientific search in the following 5 online network databases from 2000 to 2016 to retrieve potential studies independently: Science Direct, EBSCO, Pub Med, CNKI and Wanfang databases. The following search keywords were used: ("Tai Chi Quan" or "Tai Ji Quan" or "Tai Chi") AND ("gao xue ya" or "high blood pressure" or "hypertension" or "xue ya" or "blood pressure"). On the other side, we connected colleagues and experts in this field to predicate if there are any related ongoing or unpublished researches existed, and connected the authors of these researches to get detailed data as we needed.

2.2 Eligibility criteria

Only the study which should be RCTs intended to assess the availability of Tai Chi for the therapy of hypertension patient were considered.

In this review, the participants should meet at least one of the current or past exact definitions of hypertension[1]. The research objects in the study were the same elderly people. However, hypertension patients combined arrhythmia, severe coronary heart disease(CHD), hepatic failure, severe heart failure, or kidney failures were excluded. But age, sex or ethnic origin were not restricted.

Trials were compared Before Tai Chi exercise (BTC) versus After Tai Chi exercise (ATC).Do Tai Chi exercise at least 3 times a week, not less than 50 minutes. If the studies were case reports or reporting the same results were excluded.

2.3 Data extraction

Two different reviewers got the data from the primary researches independently. The extraction data form consisted of 4 parts: (1) the study's general information, (2) the detailed information of participants,(3) the information of the method used of Tai Chi, (4) the detailed information of Blood Pressure (BP), Total triglyceride (TG), Total cholesterol (TC), Heart rate (HR),Nitric Oxide(NO), High density lipoprotein cholesterol(HDL-C), Low density lipoprotein cholesterol(LDL-C) changes.

2.4 Quality assessment

We used the revised Jadad scale to evaluate the quality of each study. The highest score was 7 points, the higher the score, the higher the quality.

2.5 Statistical analysis

Revman5.2 software was used to analyze data and publication bias. Measurable data were provided by all of the included researches, and reported the weighted mean difference (WMD) with its 95% confidence interval (CI). I squared (I^2) statistic was employed to assess heterogeneity and when I^2> 50%, the heterogeneity was significant. The fixed effects model was taken to analyze the studies. We considered $P < 0.05$ to be statistically significant.

3 Results

3.1 Document Indexing and Research characteristics

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We searched 76 articles, depending on the basis of literature into and exclusion the filtered criteria, finally, we got 13 studies in this review[4-16]. Figure 1 depicts the study selection's detailed process. Tables 1 shows the essential features of the included summarized themes and trials.

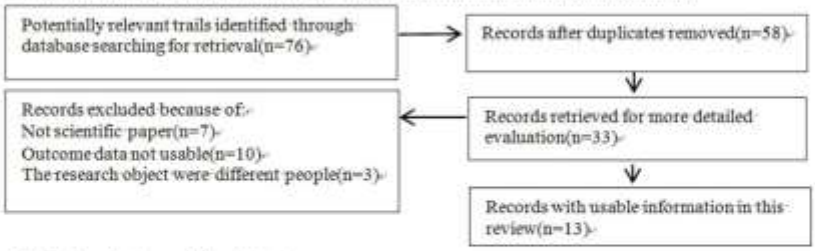

Figure 1. Study selection and identification process.

3.2 The quality of the research's methodology

The revised Jadad Scale was used to assess the quality of the studies. The score of the included subjects and trials are in Table 1.

Table 1. The included trials basic characteristics.

References	Age(yrs)	BTC (n)	ATC (n)	Male/Female	Intervention	Treatment and duration	Primary outcomes	Jadad score
JEN-CHEN et al. 2003[1]	51.6± 16.3	44	37	19/18	Yang-style Tai Chi	3times/week,50minutes /time,12weeks	(1)(2)(3)(6)(7) (8)	3
Hui-Ming Lo et al.2012[2]	58.47± 7.46	37	27	15/12	Yang-style Tai Chi	3times/week,60minutes /time,8weeks	(1)	3
Jing Sun et al. 2015[3]	45–65	150	136	117/19	Tai Chi	3h/week,12months	(1)(2)(3)(5)(7) (8)	3
WANG Xiao-jun et al.2011[4]	50–70	30	30	9/21	Tai Chi	5times/week,60minutes /time,16weeks	(1)(2)	2
JIN Zhen-yang en al.2012[5]	61± 3.7	80	80	57/23	24-style Tai Chi	7times/week,2h/time,6 months	(2)	1
Sun Feng et al. 2014[6]	60–70	45	38	14/24	24-style Tai Chi	7times/week,2h/time,8 weeks	(1)(2)(3)	3
He You-ping et al.2012[7]	35–64	52	52	28/24	Chen-style Tai Chi	7times/week,80minutes /time,3months	(2)(4)	2
Xie Hui-juan et al.2014[8]	60–70	50	50	25/25	24-style Tai Chi	5times/week,60minutes /time,12weeks	(1)(4)	1
Mao Hong-ni et al.2008[9]	63.16± 6.43	50	50	30/20	Tai Chi	5–6times/week,60minutes/time,8weeks	(4)	1
He Jing-he et al.2011[10]	51.6± 5.3	33	33	NS	24/42/48-style Tai Chi	6times/week,40–50minutes/time,20weeks	(1)(2)(3)(6)	2
Mao Hong-ni et al.2006[11]	45–72	62	62	15/47	24-style Tai Chi	6times/week,60minutes /time,8weeks	(1)(2)(4)	2
Li Chuan-wu et al.2007[12]	58± 5	16	16	16/0	24/48-style Tai Chi	5times/week,60minutes /time,6months	(5)(6)(7)	1
Zhong Yun-jian et al.2009[13]	41–46	14	14	NS	83-style Tai Chi	6times/week,60minutes /time,16weeks	(2)(5)(6)(8)	2

Abbreviation: NS: Not given; BTC: Before Tai Chi exercise; ATC: After Tai Chi exercise;
(1)SBP; (2)DBP; (3)HR; (4)NO; (5)TC; (6)TG; (7)LDL-C; (8)HDL-C.

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3.3 Meta-analysis results

3.3.1 SBP and DBP

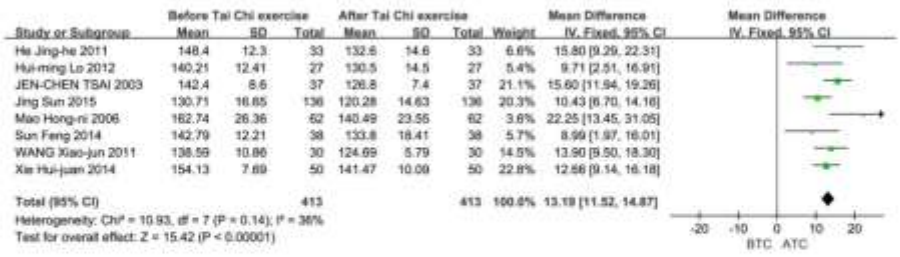


Figure 2. The forest figure of Systolic blood pressure.

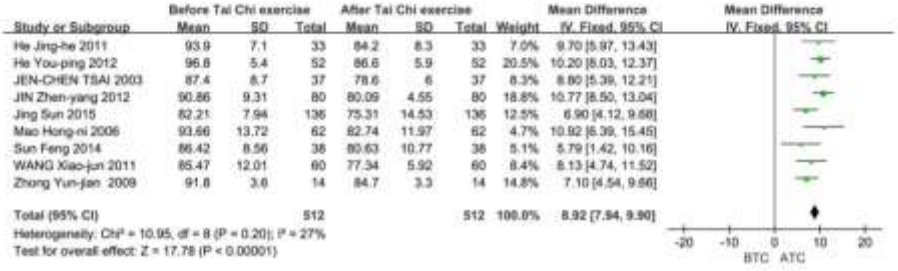
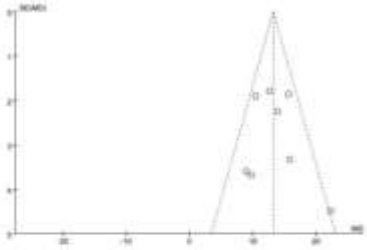


Figure 3. The forest figure of Diastolic blood pressure.



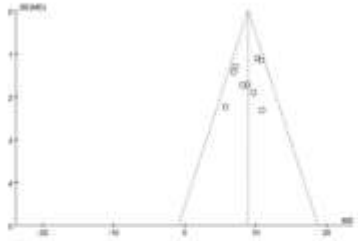


Figure 4. The funnel figure of Systolic blood pressure. **Figure 5.** The funnel figure of Diastolic blood pressure.

There is no risk of publication bias through the funnel figure (Figs.4&5).These trials demonstrated no significant heterogeneity with I^2 values ranging from 27 to 36% (Figs.2&3). The meta-analysis found that after Tai Chi exercise (ATC) can significantly reduce the SBP (WMD = 13.19 mmHg; 95%CI: 11.52 to 14.87; P<0.0001) and DBP (WMD = 8.92 mmHg; 95% CI:7.94 to 9.90; P<0.0001) compared to before Tai Chi exercise(BTC)(Figure 2& Figure 3).

3.3.2 Other outcomes

Other outcomes: HR, NO, TC, TG, LDL-C, HDL-C.(1)HR. 3 trials evaluated the effect of Tai Chi on HR. Demonstrated no significant change of HR(WMD = 1.64; 95%CI: -0.51 to 3.97; P =0.14)by ATC

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was identified compared BTC.(2)NO. 5 trials evaluated the effect of Tai Chi on NO.ATC significantly improved the content of NO(WMD =-7.98mmol/L; 95%CI: -10.63 to -5.33; P<0.0001). (3)TC. 3 trials evaluated the effect of Tai Chi on TC. Demonstrated no significant change of TC (WMD = -0.03mmol/ml; 95%CI: -0.22 to 0.17; P =0.80) by ATC was identified compared BTC.(4)TG. 4 trials evaluated the effect of Tai Chi on TG. ATC significantly reduced the TG content(WMD =0.22mmol/ml; 95%CI: 0.06 to 0.38; P =0.006).(5)LDL-C. 3 trials evaluated the effect of Tai Chi on LDL-C. ATC significantly decreased the content of LDL-C(WMD =0.20 mmol/ml;95%CI:0.13 to 0.26; P<0.0001).(6)HDL-C.3 trials evaluated the effect of Tai Chi on HDL-C. ATC demonstrated no significant change of HDL-C(WMD =-0.04 mmol/ml; 95%CI: -0.09 to 0.01; P =0.13).

4 Discussions

4.1 Summary of evidence

Tai Chi, as an exercise for health in a wide age range, has been used for several centuries, especially popular in the elderly[4]. Of course, we need to identify a suitable exercise regimen targeted to maintain and improve hypertension patients health[5].This study researched if Tai Chi is an safe and effective therapy methods of hypertension patients.

In conformity with the outcome measures from 13 RCTs with a total of 625 participants, this meta-analysis and systematic review study is to give an objective assessment of Tai Chi for the arrangement of hypertension patients. The meta-analysis found that after Tai Chi exercise (ATC) showed a clinically obvious improvement on the SBP (decreased by 13.19 mmHg), DBP (decreased by 8.92 mmHg), NO (increased by 7.98mmol/L), TG (decreased by 0.22mmol/ml) and LDL-C (decreased by 0.20 mmol/ml).NO is a very important biological messenger and signal molecule, also it is a formidable vasodilator factor[14].This study shows that Tai Chi exercise can increase the content of NO. Research found that hypertension and dyslipidemia are frequently existing together, and people with these conditions will have an increased cardiovascular disease risk[17-19]. This study shows that Tai Chi exercise can modulate lipid metabolism. We need to concern how long and how often Tai Chi exercise should be practiced for the therapy of hypertension patients? In this study, all of the trials duration included are ranged from 8 weeks to 1 year. So, we recommended that Tai Chi exercise should be practiced at least for 8 weeks and at least 3times/week. Hence, the combined results show that Tai Chi exercise is an effective and relatively-safe supplemental method for the therapy of hypertension patients.

4.2 Limitations

In spite of the significant active results of Tai Chi exercise for the therapy of hypertension patients, a lot of limitations also need to be noted. First, most of the trials included did not report the sample sizes calculating methods, and whether the number of participants involved met the research requirements or not is still not clear. Second, the small sample sizes and generally poor methodological quality limited the strength feasibility and generally poor methodological quality of the clinical evidence[15,16]. Third, because we only enrolled Asian hypertensive patients, there were no data about the effectiveness of Tai Chi exercise on other national's BP. So, the potential selection bias couldn't be ruled out. Fourth, the included trails used different styles of Tai Chi exercise. Finally, although the effects of Tai Chi exercise on BP outcomes were reported, but there are still a lot of recessive results that were difficult to be published. Therefore, further studies are needed.

5 Conclusions

This study shows that Tai Chi exercise is an effective treatment for hypertension patients. This can decrease SBP, DBP, TG, LDL-C and increase NO. However, more reasonable designed RCTs are still

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warranted before it can be used, and more methodologically rigorous researches are needed to prove Tai Chi's real clinical benefits, and needed to explore the potential mechanism of Tai Chi.

References

1. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). J Am Med Assoc311:507–20(2014).
2. Papadakis MA. Current Medical Diagnosis & Treatment 2004, 43rd ed. New York: McGraw-Hill. 401(2004).
3. Eckel RH, Jakicic JM, Ard JD, et al. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association task force on practice guidelines. Circulation 129:S76–99(2014).
4. JEN-CHEN TSAI,WEI-HSIN WANG,et al. The Beneficial Effects of Tai Chi Chuan on Blood Pressure and Lipid Profile and Anxiety Status in a Randomized Controlled Trial. THE JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE 9:747-754(2003).
5. Hui-Ming Lo,et al.A Tai Chi exercise programme improved exercise behavior and reduced blood pressure in outpatients with hypertension. International Journal of Nursing Practice 18: 545–551(2012).
6. Jing Sun,et al.Community-Based MindeBody Meditative Tai Chi Program and Its Effects on Improvement of Blood Pressure, Weight, Renal Function, Serum Lipoprotein, and Quality of Life in Chinese Adults With Hypertension. Am J Cardiol 116:1076e1081(2015).
7. WANG Xiao-jun,et al. Empirical Study of Taijiquan Interventions on the Prevention and cure of Hypertension. Journal of Beijing Sport University 9:75-77(2011).
8. JIN Zhen-yang, et al. Effect of Tai Chi on the hypertension and blood lipid level among middle aged people. Modern Preventive Medicine39:4468-4471(2012).
9. Sun Feng et al. Intervention effect of taijiquan exercise on senile hypertension. Chinese journal of gerontology 34:6862-6864(2014).
10. He You-ping et al. The Effect and Mechanism of Taijiquan on Primary Hypertension. Journal of Anhui Normal University (Natural Science) 35:83-87(2012).
11. Xie Hui-juan et al. Gaseous Signal Molecular Mechanism of Taijiquan's Intervention in Aged Essential Hypertension. Journal of Wuhan Institute of Physical Education48:51-63(2014).
12. Mao Hong-ni et al. Tai chi balance cycle of NO/ET in patients with essential hypertension. Chinese journal of gerontology 28:508-509(2008).
13. He Jing-he et al. Taijiquan research on effect of intervention in patients with essential hypertension. Chinese Journal of Rehabilitation Medicine 26:968-971(2011).
14. Mao Hong-ni et al. Effect of Tai Chi exercise on blood pressure, plasma nitrogen monoxidum and endothelin in hypertensive patients. Chinese Journal of Clinical Rehabilitation 48:65-67(2006).
15. Li Chuan-wu et al. Effect of Taijiquan on endothelial diastolic function in the elder ly. Journal of Clinical Rehabilitative Tissue Engineering Research 27:5414-5416(2007).
16. Zhong Yun-jian et al. Effects of single acute Taijiquan exercise on essential hypertension. J Fourth MilMed Univ 30:3136-3139(2009).
17. Haffner SM, Miettinen H, Gaskill SP, Stern MP. Metabolic precursors of hypertension. The San Antonio heart study. Arch Intern Med 156:1994e2001(1996).
18. Oparil S,Zaman MA,Calhoun DA. Pathogenesis of hypertension. Ann Intern Med 139:761e776. (2003).
19. Stamler J, et al. Prevalence and prognostic significance of hypercholesterolemia in men with hypertension. Prospective data on the primary screeners of the Multiple Risk Factor Intervention Trial. Am J Med80:33e39(1986).

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Proposing a Healthy Environment for Elderly People with Hypertension: Taichi gymnastic against blood pressure

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Abstract. Hypertension is a problem which is often undergone by elderly people and become an important factor caused heart trouble. Hypertension prevalence is 32.4%, and in the place of this study, hypertension prevalence numbers 50 from 80 elderly people. The design of this study used was quasi experimental non equivalent control group design. The populations were all of elderly people with hypertension as much as 50 elderly people, the samples were 46 elderly people, who was divided into experimental and control groups, each of them were 23 elderly people. The data were obtained through observation analyzed with Wilcoxon signed ranks test, whereas to understand the difference between before after Tai Chi gymnastics used Mann Whitney test. The result of analysis with Wilcoxon signed ranks test was p=0,000 < α=0.05 which meant that there is the effect of Tai Chi gymnastics towards the decrease of blood pressure, while by using Mann Whitney test was gained p=0,016 < α=0.05, that there was the difference between before and after Tai Chi gymnastics. From the result of the study, it proved that Tai Chi gymnastics can lower the blood pressure if it was undertook three times a week to elderly people with hypertension.

Keywords: Elderly people, Hypertension, Tai Chi Gymnastics

1. Introduction

Hypertension is a circulatory system disorder that causes a rise in blood pressure above normal, which exceeds 140/90 mmHg. In general, the risk of blood pressure increases slowly with increasing age, systolic pressure continues to increase until the age of 80 years and diastolic pressure can continue to increase until the age of 55-60 years and sometimes decrease slowly. Hypertension is a disease that is often experienced by the elderly and it is a major factor in the causes of heart failure and coronary heart disease. Hypertension has become a major health problem in the world. According to the World Health Organization (WHO) noted that in 2012 at least 893 million cases of hypertension, and is expected to increase in 2025 to 1.15 billion, about 80% of cases of hypertension occur mainly in developing countries. In Indonesia, based on the National Health Indicator Survey (Sirkenas) in 2016 showed the prevalence of hypertension reached 32.4%. In East Java the prevalence of hypertension reached 10.7%. In Surabaya, based on Surabaya's health profile in 2014-2016 the prevalence of hypertension has increased from 3.34% to 10.43% and based on data obtained from the Sidotopo Wetan Health Center Surabaya the prevalence of hypertension in 2014-2016 has increased from 261 patients were 657 patients.

Whereas it based on the initial survey conducted in November 2017 at the Posyandu Lansia RW.05 Sidomulyo Sidotopo Wetan Village, Kenjeran Subdistrict, Surabaya the prevalence of hypertension is 50 out of 80 elderly. The increasing number of hypertensive patients in the world, making this disease a global health problem. The incidence of hypertension is caused by several factors including gender, offspring, bad diet, obesity, never exercising, smoking, drinking alcohol, and often stress, so that proper handling is needed. However, in fact this disease has properties that tend to be unstable and difficult to control, either by treatment or other medical measures. Non-adherence to treatment and prolonged stress can make this disease worse, the administration of drugs for a long time can be detrimental and have a negative impact on the body, therefore drug therapy needs to be given along with non-pharmacological therapy.

Hypertension treatment is broadly divided into two, namely dealing with pharmacological and non-pharmacological treatment. Pharmacological treatment is handling using drugs or compounds that work that can affect blood pressure, grouping pharmacological therapies used to control blood pressure of hypertensive patients such as diuretics, adrenergic inhibitors, ACE-inhibitors, Angiotensin-II-blockers, calcium angiotension, vasodilators direct, and hypertension emergencies such as malignant hypertension. Non-pharmacological treatment is the treatment without the use of antihypertensive drugs, for example hypertension sufferers must do physical activity and exercise regularly. Types of physical activity and exercise that can be done for example by morning walking, cycling, or gymnastics, because exercising regularly for 30-45 minutes with a frequency of 3-5 times a week can help reduce body weight and reduce the risk of various cardiovascular diseases. While the type of effective exercise for the elderly is aerobic exercise with moderate intensity such as walking and elderly gymnastics, types of exercise that are usually carried out by the elderly, low impact aerobics or slow motion exercises such as Tai Chi exercises. The Tai Chi exercise is a form of way to reduce blood pressure in the elderly who suffer from hypertension, because with Tai Chi exercise routinely can make the muscles relax and reduce stress, thereby reducing the production of catecholamine and cortisol hormones and can reduce renin and angiostensin production which are the main factors trigger the occurrence of hypertension. Based on previous research conducted by Anik Supriani in 2014, it was stated that Tai Chi exercises can reduce blood pressure if carried out regularly with a frequency of 3 times a week for 1 month with the time used for Tai Chi exercises 15-30 minutes. Regular physical exercise can result in a working efficiency of the heart, the heart muscle becomes stronger, therefore it can contract less in pumping the same amount of blood, this decrease in heart rate can reduce cardiac output which can eventually lower blood pressure.

The purpose determined the effect of Tai Chi exercise on blood pressure reduction in elderly people with hypertension at the elderly elderly Posyandu RW. 05 Sidotopo Wetan Surabaya.

2. Methodology

The design used experimental with a non equivalent control group design quasi experimental design. The population was all elderly people with hypertension in the elderly Posyandu RW. 05 Sidomulyo Sidotopo Wetan Village, Kenjeran Subdistrict, Surabaya, as many as 50 respondents with non-probability purposive sampling technique. The sample was 46 elderly with blood pressure inclusion criteria exceeding 140/90 mmHg and taking antihypertensive drugs which were divided into treatment and control groups, each amounting to 23 elderly. The instrument used in the type of manual tensimeter and stethoscope for blood pressure measurement, Tai Chi gymnastic exercise activity unit and gymnastic tape, observation sheet of blood pressure measurement pre and post exercise in Tai Chi. This research was conducted in December 2017, before conducting the research, the researcher explained the purpose and objectives of the study as well as providing informed consent and consent sheets to become respondents for the elderly who were willing to become respondents. Before Tai Chi gymnastics, blood pressure measurements were taken in both groups of elderly people.

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Then the next day performed Tai Chi exercises in the treatment group for 3 times in 30-45 minutes, and the following day blood pressure measurements were taken again in both groups of the elderly. The data collected through observations were analyzed by Wilcoxon signed ranks test to determine the effect of Tai Chi exercise on blood pressure reduction, while to determine differences in blood pressure before and after Tai Chi exercise using the Mann Whitney test.

3. Research Result

3.1 General Data

Table 1.1 Distribution of Respondent Frequency by Gender at the Elderly Posyandu RW. 05 Sidotopo Wetan Surabaya in 2017

No.	Age	treatment and control of groups	
		Frequency (f)	Percentage (%)
1	60-74 years *(elderly)*	25	54%
2	75-90 years *(old)*	21	46%
3	>90 years *(very old)*	0	0%
	Total	46	100%

Based on table 1.1, the results obtained in the elderly treatment and control groups were mostly aged 60-74 years as many as 25 respondents (54%) and none> 90 years old were 0 respondents (0%).

Table 1.2 Distribution of Frequency of Respondents by Gender at the Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No.	Sex	treatment and control of groups	
		Frequency (f)	Percentage (%)
1	Male	13	28%
2	Famale	33	72%
	Total	46	100%

Based on table 1.2, the results obtained in the elderly treatment and control groups were mostly female, as many as 33 respondents (72%) and almost half were male as many as 13 respondents (28%).

Table 1.3 Distribution of Frequency of Respondents Based on drug consumption in the Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No.	Medicine Consumption	treatment and control of groups	
		Frequency (f)	Percentage (%)
1	Consumption	23	100%
2	Not Consumption	0	0%
	Total	46	100%

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Based on table 1.3, the results were obtained in the elderly, the treatment and control groups were all taking drugs as many as 23 respondents (100%) and no one did not consume drugs as many as 0 respondents (0%).

Table 1.4 Distribution of Frequency of Respondents Based on body weight at Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No.	Weight	treatment and control of groups	
		Frequency (f)	Percentage (%)
1	*Underweight* (thin)	5	11%
2	*Normal* (ideal)	23	50%
3	*Overweight* (fat)	14	30%
4	*Obese* (obesity)	4	9%
	Total	46	100%

Based on table 1.4, the results were obtained for the elderly in the normal half-weight treatment and control group as many as 23 respondents (50%) and a small portion of obesity was 4 respondents (9%).

Table 1.5 Distribution of Frequency of Respondents Based on Employment at Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No	Occupation	treatment and control of groups	
		Frequency (f)	Percentage (%)
1	Not working / retired	37	80%
2	Driver	1	2%
3	Trader	5	11%
4	Tailor	1	2%
5	Pedicab driver	2	4%
	Total	46	100%

Based on table 1.5, the results obtained in the elderly treatment and control groups almost all were unemployed / retired as many as 37 respondents (87%) and a small part of the work was driver and tailor as many as 1 respondent (2%).

***3.2** Specific data*

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Table 2.1 Distribution of Respondents' Frequency Based on blood pressure before Tai Chi exercises in the treatment and control group of elderly hypertensive patients at the Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No	Hypertension category	Treatment group	
		Frequency (f)	Precentage (%)
1	Normal	0	0
2	Prehypertension	0	0
3	Hypertension TK 1	11	48
4	Hypertension TK 2	12	52
	Total	23	100

No	Hypertension category	Control group	
		Frequency (f)	Precentage (%)
1	Normal	0	0
2	Prehypertension	0	0
3	Hypertension TK 1	18	78
4	Hypertension TK 2	5	22
	Total	23	100

Based on table 2.1, the results of blood pressure were obtained before tai chi gymnastics in the treatment group most experienced hypertension level 2 as many as 12 respondents (52%) and none experienced prehypertension and normal as many as 0 respondents (0%) while in the control group almost all had hypertension level 1 as many as 18 respondents (78%) and none experienced prehypertension and normal as many as 0 respondents (0%).

Table 2.2 Distribution of Respondent Frequency Based on Blood Pressure After Tai Chi Gymnastics in the treatment and control group of elderly hypertensive patients at the Posyandu for Elderly RW. 05 Sidomulyo Sidotopo Wetan Surabaya in 2017

No	Hypertension category	Treatment group	
		Frequency (f)	Precentage (%)
1	Normal	0	0
2	Prehypertension	9	39
3	Hypertension TK 1	14	61
4	Hypertension TK 2	0	0
	Total	23	100

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Based on table 2.2 obtained the results of blood pressure after tai chi gymnastics in the treatment group most experienced hypertension level 1 as many as 14 respondents (61%) and none experienced hypertension level 2 and normal as many as 0 respondents (0%). Whereas in the control group most of them experienced level 1 hypertension as many as 17 respondents (74%) and none were normal as many as 0 respondents (0%).

Table 2.3 Wilcoxon Statistical Test Results Signed Ranks Test Using IBM SPSS 20.0

	TD after treatment - TD before	TD treatment after the control group - TD before the control group
Z	-4.472[b]	-1.890[b]
Asymp. Sig. (2-tailed)	.000	.059

Based on table 2.3 with the Wilcoxon signed ranks test statistical test in the treatment group obtained the significance value of $p = 0.000 < \alpha = 0.05$. This meant that H0 was rejected and it could be concluded that there was an influence of Tai Chi gymnastics on blood pressure reduction in elderly treatment group hypertensive patients

Table 2.4 Statistical Test Results Mann-Whitney Test uses IBM SPSS 20.0

	TD before the treatment group vs. control	TD after treatment vs control group
Mann-Whitney U	195.500	174.500
Wilcoxon W	471.500	450.500
Z	-1.837	-2.404
Asymp. Sig. (2-tailed)	.066	.016

Based on table 2.4 with the statistical test mann-whitney test results of blood pressure measurements was before (pretest) in the treatment group and control group obtained the significance value of $p = 0.066 > \alpha = 0.05$. This meant that H0 was accepted and it could be concluded that there was no difference in blood pressure before (pretest) in the treatment and control groups. While the results of post-test blood pressure measurements in the treatment and control groups obtained the significance value of $p = 0.016 < \alpha = 0.05$. This meant that H0 was rejected and it could be concluded that there was a difference in posttest blood pressure in the treatment and control groups.

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4. Discussion

4.1 Identification of blood pressure before Tai Chi exercises in the treatment and control group of elderly people with hypertension at the Posyandu Lansia RW. 05 Sidotopo Wetan Surabaya

Based on the results of blood pressure measurements before Tai Chi exercises in the treatment group, the results showed that most of the patients had level 2 hypertension as many as 12 respondents (52%), level 1 hypertension were 11 respondents (48%), and none experienced prehypertension or normal 0 respondents (0%). Whereas in the control group almost all experienced hypertension level 1 as many as 18 respondents (78%), hypertension level 2 as many as 5 respondents (22%), and none experienced prehypertension or normal as many as 0 respondents (0%). These variations could be influenced by several factors including age, sex, psychological and physical stress, obesity, unhealthy eating patterns, and lack of physical activity.

Based on age factor, the results of most of the elderly in the treatment and control groups aged 60-74 years were 25 elderly (54%). This research is in line with the results of research conducted by Agnesia Nurarima (2012) stating that the risk of developing hypertension at the age of 60 years and over 11.340 times greater than the age of less than 60 years. Another research also states that as many as 75% of elderly people aged 65 and above consider themselves in good health conditions and perfect, elderly physical and cognitive functions become indicators of physical health, changes in organic and systemic systems vary widely, both between individuals and individuals alone and some body systems decrease rapidly. According to Nurarif & Kusuma (2015) the increasing age of a person, there was a decline in the body's system, namely the elasticity of the aortic wall decreases, the heart valve thickens and becomes stiff, the heart's ability to pump blood decreases 1% every year after 20 years old, loses the elasticity of blood vessels so increase capillary vascular resistance and increase blood pressure.

Based on gender, the elderly in the treatment and control groups who came to the posyandu were mostly female with 33 elderly (72%). In a previous study conducted by Rustiana (2014) stated that the incidence of hypertension was greater in female sex than men in women at 67.2% while men were 32.8% [9]. According to Dalimartha (2008), in women there is an increase in blood pressure that is after experiencing menopause because when menopause occured a decrease in estrogen hormone which causes changes in endhotelian function resulting in increased activity of the sympathetic nerves which will then release renin stimulants and converted to angiotensin 2 causing vasoconstriction and increase in blood pressure.

Based on body weight, it was found that half (50%) of the elderly treatment and control groups who came to posyandu were of normal weight and a small portion (9%) were obese. In a previous study conducted by Agnesia Nurarima (2012) stated that obesity was proven to be a risk factor for hypertension. This shows people with obesity have a risk of developing hypertension 9,051 times greater than people who are not obese. According to Garnadi (2012) obesity and obesity will aggravate the work of the heart to pump blood and other vital organs will also get a burden due to the accumulation of fat in the body so that it can cause hypertension.

Based on physical activity, almost all (80%) elderly treatment and control groups who came to the posyandu did not work / retire so they were always at home and rarely engaged in physical activity. In a previous study conducted by Anggara (2013) stated that people who do not exercise regularly have a risk of developing hypertension by 44.1 times compared with people who have regular exercise habits. Other studies state that the health status and function of the body, the presence of illness, and health care are factors that affect physical activity. According to Garnadi (2012) lack of physical activity causes the heart to be untrained, blood vessels stiff, blood circulation does not flow smoothly, causing obesity, and this factor is the cause of hypertension.

4.2 Identification of blood pressure after Tai Chi exercises in the treatment and control group of elderly Hypertension sufferers at Posyandu Lansia RW. 05 Sidotopo Wetan Surabaya

Based on the results of blood pressure measurements after being given Tai Chi exercise for 3 times in 1 week, the results showed that the treatment group mostly experienced hypertension level 1 as many as 14 respondents (61%), prehypertension as many as 9 respondents (39%), and none had hypertension level 2 and normal are 0 respondents (0%). Whereas in the control group most of them experienced hypertension level 1 as many as 17 respondents (74%), prehypertension as many as 3 respondents (13%), hypertension level 2 as many as 3 respondents (13%), and no normal as many as 0 respondents (0%). From these results there is a change in blood pressure in the treatment group after Tai Chi exercise which is initially a level 2 hypertension prevalence of 52% and after Tai Chi exercise becomes 0%. While in the control group there was also a change, namely the prevalence of hypertension level 2 decreased from 22% to 13%, the decrease in blood pressure in the control group was due to the control group taking antihypertensive drugs. In a previous study conducted by Anik Supriani (2014) stated that almost all hypertensive patients overcome hypertension by taking antihypertensive drugs and rarely with a healthy lifestyle.

According to Istifa (2011) Tai Chi Gymnastics is traditional Chinese exercise with slow motion, deep breathing, and concentration of mind with elements of meditation. Tai Chi exercises are known to help control stress which is one of the risk factors for hypertension, with proper breathing exercises combined with light muscle exercises can make a person relax. Deep breathing techniques and slow movements could increase the concentration of oxygen in the blood, facilitate blood flow, and reduce heart rate.

4.3 Analysis of the effect of Tai Chi gymnastics on blood pressure reduction in the treatment and control group of elderly hypertensive patients in the Posyandu Lansia RW. 05 Sidotopo Wetan Village, Kenjeran Subdistrict, Surabaya

Based on the results of the statistical test of wilcoxon signed ranks test obtained the significance value of pre-post in the treatment group was $p = 0{,}000 < \alpha = 0{,}05$ which meant that H0 was rejected and there was influence of Tai Chi exercise on blood pressure reduction. Whereas in the control group obtained a value of $p = 0.059 > \alpha = 0.05$, which meant that H0 was accepted and there was no influence. The decrease in blood pressure in the treatment group was influenced by the provision of Tai Chi gymnastics.

According to Sutanto (2013) Tai Chi gymnastics was a form of way to reduce blood pressure in the elderly who suffer from hypertension, because Tai Chi exercises routinely could make the muscles relax and reduce stress, thereby reducing the production of catecholamine and cortisol hormones and could reduce renin production and angiostensin which was the main factor that triggers hypertension. Based on a previous study conducted by Anik Supriani (2014) states that Tai Chi exercises can reduce blood pressure if carried out regularly with a frequency of 3 times a week for 1 month with the time used for Tai Chi exercises 15-30 minutes. Regular physical exercise can result in a working efficiency of the heart, the heart muscle becomes stronger so it could contract less in pumping the same amount of blood, this decrease in heart rate can reduce cardiac output which could eventually lower blood pressure.

4.5 Analysis of differences in blood pressure were before and after gymnastic Tai Chi treatment and control groups in elderly hypertensive patients in Posyandu Lansia RW. 05 Sidotopo Wetan Village, Kenjeran District, Surabaya

Based on the results of statistical tests mann-whitney test treatment and control group obtained the significance value of p = 0.066> α = 0.05. This meant that H0 was accepted and it could be concluded that there was no difference in blood pressure before (pretest) in the treatment and control groups. While the results of post-test blood pressure measurements in the treatment and control groups obtained the significance value of p = 0.016 <α = 0.05. This meant that H0 was rejected and it could be concluded that there was a difference in posttest blood pressure in the treatment and control groups

Based on the results of the study, blood pressure in the treatment group was before and after being given Tai Chi gymnastics tended to change, which was initially categorized in level 2 hypertension to level 1 hypertension and prehypertension ie systolic blood pressure between 120-140 mmHg and diastolic between 80-100 mmHg. While blood pressure in the control group also experienced changes due to taking antihypertensive drugs. The results showed that in line with the research conducted by Anik Supriani (2014) which stated that there was a difference in the mean posttest value of the experimental group obtained a systolic pressure of 136 mmHg, mean diastolic pressure of 84 mmHg, whereas the control group obtained an average systolic pressure of 144mmHg, and the mean pressure diastolic by 90 mmHg.

Tai Chi exercise is one of the sports from China that resembles meditation therapy with soft movements. The Tai Chi movement which includes body-mind-breath-breath is regularly proven to increase the release of nonadrenaline in the urine, reduce cortisol levels which is a trigger of stress, and reduce sympathetic nerve activity which has a positive impact on the heart (in the form of a stable heart rate and pressure blood drops to normal), This is because sympathetic and parasympathetic nerve activity becomes balanced and harmonious. These exercises can also increase antioxidants to remove free radicals in the body and stabilize blood pressure.

5. Conclusion

1) Elderly blood pressure was before Tai Chi exercises in the treatment group mostly experienced hypertension level 2. While in the control group almost all had hypertension level 1.
2) Blood pressure Elderly was after Tai Chi exercises in the treatment group most experienced hypertension level 1. While in the control group most experienced hypertension level 1.
3) There was influence of Tai Chi exercises on blood pressure reduction in elderly hypertensive patients, with a value of p = 0,000 <α = 0.05.
4) There was a difference in blood pressure after (posttest) between the treatment group and the control group in elderly hypertension with a value of p = 0.016 <α 0.05.

5. References

[1] Hussain M, Mamun A, Reid C, RR H. Prevalence, Awareness, Treatment and Control of Hypertension in Indonesian Adults Aged ≥40 Years: Findings from the Indonesia Family Life Survey (IFLS). PLoS ONE. 2016 Aug: p. 1-6.

[2] Krakoff LR. Hypertensive urgencies: The epidemic, causes, and consequences. American Journal of Hypertension. 2017: p. 464-465.

[3] Nasrullah D, Wibowo AN. Efektifitas Terapi Muscong (Musik Keroncong) Untuk Menurunkan Intensitas Nyeri Pada Pasien Arthitis Rhemathoid (Studi Kasus Panti Werdha Surabaya Timur). Jurnal Keperawatan Muhammadiyah. 2016: p. 115-121.

[4] Ziyu L, Lili Y, Yaoyao B, Li Z, Mingzhen L, Yun S, et al. Effects of Tai Chi on Adults with essential hypertension in China: A Systematic review and meta-analysis. European Journal of Integrative Medicine. 2017 June: p. 153-162.

[5] Supriani A. Pengaruh Senam Tai Chi terhadap Penurunan Tekanan Darah. Jurnal Keperawatan dan kebidanan. 2013: p. 31-39.

[6] Nurarima A. Faktor Resiko Hipertensi Pada Masyarakat di Desa Kabongan Kidul Kabupaten Rembang. In Fakultas Kedokteran Universitas Diponegoro Semarang; 2012; Semarang.

[7] Festi P. Pengembangan Indikator dan INDEKS Kesejateraan Lanjut Usia di Surabaya. Disertasi ed. Surabaya: FKM Universitas Airlangga SurabayaFKM Universitas Airlangga Surabaya; 2017.

[8] Nurarif AH, Kusuma H. Aplikasi Asuhan Keperawatan Berdasarkan Diagnosa Medis & NANDA NIC-NOC Jogjakarta: MediAction; 2015.

[9] Rustiana. Gambaran Faktor Resiko Pada Penderita Hipertensi di Puskesmas Ciputat Timur. Skripsi ed. Jakarta: Fakultas Kedokteran dan Ilmu Kesehatan UIN Jakarta; 2014.

[10] Lee P, Liew S, Abdullah A, Abdullah N, Ng C, Hanafi N, et al. Healthcare Professionals' and Policy Makers' Views on Implementing a Clinical Practice Guideline of Hypertension Management: A Qualitative Study. PLoS ONE. 2008 May: p. 1-12.

[11] Anggara , Prayitno. Faktor-faktor yang Berhubungan dengan Tekanan Darah di Puskesmas Telaga Murni Cikarang Barat Jakarta. Jurnal Ilmiah Kesehatan. 2013; 5(1).

[12] Zhang Y, Fu Y, Zhu B, Li C, Lin X. Effect of Tai Chi exercise for hypertension: a meta-analysis of randomized controlled trials. BIO Web of Conferences. 2017: p. 1-6.

[13] Sutarno J. The Dancing Leader 2.0 Jalan Cerdas Menuju Sehat Jakarta: PT. Kompas Media Nusantara; 2013.

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Research Paper:

Effect of Tai Chi Exercise on the Stress of Elderly Women With Hypertension

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Elderly, Stress, Hypertension, Tai Chi

ABSTRACT

Background: Hypertension or high blood pressure is one of the most common chronic diseases among the geriatrics having a strong association with psychological factors such as perceived stress. Aerobic exercises are effective in the prevention and treatment of hypertension and stress management. In the same regard, this paper is an attempt to investigate the effect of Tai Chi exercise on the stress of Iranian older women with hypertension.

Methods: This clinical trial with pre and posttest quasi-experimental design was conducted on 64 elderly women with hypertension at two elderly care centers in Tehran. This study included 8-form Tai Chi exercise for a period of six weeks. For collecting data, two questionnaires with demographic characteristics and the Perceived Stress Scale (PSS) were used, and for analyzing data, descriptive and inferential statistics were employed in SPSS-PC V21 software.

Results: The results showed that there was no significant difference in perceived stress in both experimental and control groups, before and after the intervention. The results of repeated measures ANOVA also showed that the mean of perceived stress score before and after intervention was not statistically significant (P = 0.557 and 0.489).

Conclusion: Since the 8-form Tai Chi exercise is a safe intervention for the elderlies has led to a significant difference in the level of perceived stress among the elderly women, further studies are suggested to find a suitable and effective style of this exercise.

1. Background

The increase in life expectancy, as well as growing older population in the world, is a major challenge. According to a report by the World Health Organization (2013), between 2000 and 2050, the proportion of the world's population over 60 years will double from about 11% to 22%, and it is expected to increase from 605 million to 2 billion over the same period. Aged people are confronted with several disabilities and limitations. Among these, hypertension or high blood pressure is considered as an important disease (Lloyd Sherlock et al. 2014). Stress is one of the major factors in hyperten-

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sion (Hapunda et al. 2015) and the mean stress intensity in people with hypertension is significantly higher than those who are not affected with the disease (Vahedian Azimi et al. 2012). It is also important to note that the perceived stress level in women is much higher than that in men. Regular aerobic exercises are one of the basic strategies for the prevention and treatment of hypertension (Lan et al. 2013).

One of the best exercises in this field is called Tai Chi, a multifactorial sport and an elderly-friendly solution according to American Society of Aging (Pho et al. 2012). Tai Chi is a traditional Chinese mind-body exercise. In Tai Chi, smooth and rhythmic movements are linked, causing the transfer of body weight from one leg to other resulting in better balance (Lan et al. 2013).Tai Chi exercise has several forms that vary in different situations (Azimzadeh, Hosseini & Nourozi Tabrizi 2013). A simplified 8-form program of Tai Chi which is derived from a complex 24-form, allows the elderlies to perform it either by standing or sitting, and let them enjoy Tai Chi exercise without having to worry about remembering different movements, an important method of controlling their stress (Lee 2017).One of the researches on Tai Chi exercise conducted by Taylor-Piliae (2014) showed that Tai Chi Quan is a safe form of exercise to prevent and manage cardiovascular disease with no side effects. They suggested that the extent and routine of Tai Chi (number of sessions, frequency, and duration) are factors that can influence the outcomes of this exercise. Yeh et al. (2008), in a systematic review, investigated the effect of Tai Chi exercise on blood pressure. They concluded that Tai Chi may reduce blood pressure and serve as a practical, non-pharmacologic method for hypertension management. According to them, there are different forms of Tai Chi. Biglari et al. (2016) studied the Effect of 8-Week Tai Chi Quan exercise and walking on cardiovascular-related indicators among Iranian elderly women. Their results indicated that Tai Chi Quan training can be recommended to people who have not enough mobility to exercise, low cost, simplicity, and its beneficial therapeutic properties.

Considering previous studies on Tai Chi exercise and lack of research on its effect on the stress of older women as a vulnerable group, this paper is aimed to study the effect of Tai Chi exercise on the perceived stress of older women suffering from hypertension.

2. Materials and Methods

This study is a clinical trial with pre and posttest quasi-experimental design. Study population consists of geriatric women with hypertension in elderly care centers in Tehran under the supervision of welfare organization. Multi-stage sampling method was applied. Firstly, the names of all elderly care centers which were introduced by the Welfare Organization and their readiness to carry out the study, were placed inside the envelope; then the names of the two centers were randomly taken out (Arad and Tohid elderly centers). Next, from these two centers, by tossing a coin, the Arad center was selected for the test group and Tohid center for the control group. Inclusion criteria for the older women who, according to the definition of the World Health Organization, should be over 60 years having no cognitive impairment by using Abbreviated Mental Test (AMT) instrument, having high blood pressure with no history of depression or anxiety disorder according to the patient or her medical record, no drug addiction or mediation or Tai Chi exercises.

At both the centers, Tohid and Arad, informed consent was taken from the study subjects (which came under the inclusion criteria) and were explained about the goals and stages of the research. The elderlies were examined with the help of cognitive impairment test and after ensuring that they had none, a demographic data form surveying age, weight, height, body mass index, duration of hypertension, underlying disease, marital status, educational level, economic situation and use of mobility aids was completed by the participants. To measure the stress level, Perceived Stress Scale (PSS) was used that was developed by Cohen et al. (1983). This tool is very suitable for measuring the people's perception of stress against the unpredictable and uncontrollable events of life. It has 14 items based on 4-point Likert scale rated as 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often. Scores are obtained by reversing the responses to the positively stated items (items 4, 5, 6, 7, 9, 10, 13). In total, scores are from zero to 56. Reliability and validity of this tool have been reported by using Cronbach's alpha coefficient ranging from 0.74 to 0.93.

The sample size was determined as n = 38 at 95% confidence level and 80% test strength in each, test and control group. Due to the long duration of intervention and the lack of familiarity of the elderlies with this exercise, three subjects in the test group due to lack of interest in continuing the Tai Chi exercise, two subjects due to cold and weakness, and one subject because of a stroke were excluded from intervention. In the control group, five elderly women said that they were not interested in filling out a post-test questionnaire, and one woman died. Finally, data from 32 samples in each, test and control group, were analyzed.

Intervention included 8-form Tai Chi exercise for thrice a week sessions, each for 40 mins, for six weeks. It should be noted that the elderly carried out Tai Chi ex-

ercise under the supervision of a researcher with Tai Chi certification. Also, the exercise was performed in the hall which can accommodate all the elderly women together. The details of the intervention are as following:

Five minutes for warm-up which included relaxation and balancing exercises (by considering the ability of each elderly woman);

20-30 minutes for performing 1-8 movements of Tai Chi as following hand and body positions by listening to Tai Chi music: 1 = Commencing form where both hands rise to shoulder level; 2 = Curving back arms; 3 = Stepping sideways and moving arms; 4 = Moving hands like clouds; 5 = Diagonal strides; 6 = Standing on one leg; 7 = Stepping and pushing; and 8 = Closing form where both hands fall to the side and left leg drawn to the right leg.

Five minutes for cooling down involving deep breathing and muscular relaxation.

The control group did not receive any special intervention apart from the routine care. Immediately after completing six weeks of intervention, the perceived stress questionnaire was completed by both test and control groups. Data were analyzed using SPSS V. 21 software. Descriptive statistics (frequency, percentage, mean and standard deviation) were used to analyze the data and to determine the statistical significance inferential statistics (Chi-square, Fisher's exact test, independent t-test, paired t-test, and repeated measures ANOVA) were used.

3. Results

The results of the demographic analysis showed that the participants of both the groups had no significant difference in terms of age, weight, height, body mass index, duration of hypertension, underlying disease, marital status, educational level, economic situation and use of mobility aids (Table 1).

The comparison of results for the perceived stress was done for the participants in both the groups, test and control. The pre-intervention stage, by independent t-test, showed that the two groups did not have any significant statistical difference (P = 0.575). The mean score of stress, before intervention, in the test

Table 1. Demographic characteristics of study participants

Variables	Group	Test Group		Control Group		P
		N	%	N	%	
Age	60-64 years	6	18.8	5	15.8	0.555
	65-69 years	14	43.8	14	43.8	
	70-74 years	4	12.5	7	21.9	
	> 75 years	8	25	6	18.8	
Educational level	Unlettered	7	21.9	5	15.6	0.676
	Lettered	21	65.6	21	65.6	
	Secondary school	4	12.5	4	12.5	
	Academic	0	0	2	6.2	
Duration of hypertension	< 25 months	14	43.8	8	25	0.353
	25-74 months	8	25	6	18.8	
	75-125 months	6	18.8	16	50	
	> 125 months	4	12.5	5	15.6	
Marital status	Married	17	53.1	21	65.6	0.446
	Divorced	1	3.1	0	0	
	Widowed	14	43.8	11	34.4	
Economic situation	Good	1	3.1	15	46.9	0.001
	Fair	22	68.8	16	50	
	Poor	9	28.1	1	3.1	

Table 2. Mean ± SD and ANOVA results of the perceived stress before and after the intervention in both the study groups

	Test Group	Control Group	Repeated Measures ANOVA	
	Mean ± SD	Mean ± SD	Intra-group	Inter-group
Before intervention	25.16 ± 7.56	26.45 ± 10.49	F = 10.27 P = 0.489	Greenhouse–Geisser test F = 2.54 P = 0.115
After intervention	23.84 ± 6.64	25.44 ± 9.87		
Variations	-1.31 ± 6.49	-1.01 ± 5.05	t = 0.208 df = 62 P = 0.836	

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Table 3. Mean ± SD and paired t-test results of the perceived stress before and after intervention in both study groups

	Test Group	Control Group
	Mean ± SD	Mean ± SD
Before intervention	25.16 ± 7.56	26.45 ± 10.49
After intervention	23.84 ± 6.64	25.44 ± 9.87
Paired t-test	t = 1.144, df = 31 P = 0.262	t = 0.130 df = 31 P = 0.267

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group was 25.16 and in the control group was 26.45. Independent t-test results also showed that after intervention, the mean score of stress in the test group was 23.84 and in the control group was 25.44, but there was no significant difference between the two groups after the intervention. Also, the results of ANOVA with repeated measures (inter-group effect) showed that the mean score of perceived stress before and after the intervention was statistically insignificant (P = 0.557). For intra-group effect, the mean score of the two groups had an insignificant statistical difference (P = 0.489) (Table 2). Independent T-test also showed that there was no significant difference in perceived stress variations in both groups (P = 0.836). Overall, there was no significant difference in the perceived stress in test group (P = 0.262) and control group (P = 0.267) before and after the intervention (Table 3).

4. Discussion

The aim of this study was to investigate the effects of Tai Chi exercise on the perceived stress of elderly women with hypertension. The mean age of elderly women with hypertension in the two groups, test (71 years) and control (70 years), was not statistically significant (P = 0.555). Also, the highest age frequency of elderlies was in the range of 65-69 years. It should be noted that these mean ages are below the younger aged group ranging from 60 to 74 years old. Regarding the Body Mass Index (BMI), BMI was 23 for test group, and it was 22 for control group, presenting that there was no significant difference between the two groups (P = 0.579). According to the division of the body mass index the elderly in this study are in the normal range, but it should be noted that the mean BMI of women is significantly higher than that of men. On the other hand, BMI is related to blood pressure therefore in hypertensive patients it is significantly more than those with normal blood pressure.

There was no significant difference between the two groups regarding the duration of hypertension (P = 0.353). In the test group, the hypertension duration for 43.8% of women was 25 months and less, while in the control group, for 50% of them it was between 75-125 months. The two groups did not have any significant difference with respect to the underlying disease, history of the disease and were homogeneous (P = 0.106). 59.4% in the test group and 78.1% in the control group had underlying diseases other than hypertension. Participants reported the abnormalities in the cardiovascular system, liver and endocrine system, musculoskeletal system as well as neurological, immune and visual systems which

indicated the diverse diseases that the elderlies were involved with. This would result in the exponential growth of health costs (Russell & Arsalan 2007).

There were insignificant differences between the two groups in terms of educational level (P = 0.676). Sixty-six percent of patients in each group were literate enough to read and write. The mean of stress severity in people with different educational levels had a significant difference with each other. There was a significant difference between the two groups in terms of economic status (P < 0.001) and more than half of the participants had a fair economic status. It seems that since the participants in this study were from the two private elderly care centers in Tehran where it requires a fair income level in order to pay the tuition; this statistical finding can be acceptable. Overall, it was concluded that there were no significant differences in the perceived stress in both test and control groups, before and after the intervention.

Several studies have been conducted over the Tai Chi exercises, some of these studies have shown results that substantiate our findings, and with others, there were no agreements. Lee et al. (2017) investigated the effects of Tai Chi on waist circumference and blood pressure of 68 elderly women aged 65 years. Simplified Yang style 24-form Tai Chi was used as the intervention, which was conducted for 5 sessions per week (60 minutes per session), for 6 weeks. They concluded that Tai Chi can be used as an effective intervention to improve waist circumference and blood pressure in the elderly. In another study by Kim et al. (2016), the mental-attention Tai Chi effect on 64 Chinese and non-Chinese adults (51–87 years old) was investigated. Their results suggested that Tai Chi can improve mental-attention, vigilance and executive control, when participants are sufficiently motivated to pursue this practice which was observed among Chinese elders. Miller and Taylor-Piliae (2014), in a review of recent researches on the effects of Tai Chi on cognitive function in community-dwelling older adults, indicated some studies that reported no significant effect of Tai Chi exercise on the performance of the study community. According to them, some of the factors such as the lack of a well designed methodology for performing Tai Chi in the elderly, can cause failure to have appropriate results from this exercise. From the review of results of various studies and their comparison with the results of our current study, it can be said that these contradictory results may be due to the selection of subjects, their gender, physical fitness, history of illness, Tai Chi style, its severity, and duration.

Different forms of Tai Chi exercise which include the style of performance, the duration of exercise and the trainer and his experience are all factors that can influence the outcome of Tai Chi's exercise. Although the duration of intervention and its frequency are mentioned in most studies; however, the time taken by any participant in the study to learn the exercise has not been taken into account, which can be an important factor for the conclusion. In sports like Tai Chi, it's important to use visual senses, imagining, relaxation and remembering the type and sequence of movements which affects the results. Each study has implemented a specific style of Tai Chi exercise; maybe because there is no unique and specific protocol of Tai Chi for the elderlies (Miller & Taylor-Piliae 2014).

Cultural differences also influence the results of intervention by Tai Chi exercise. The familiarity of the elderlies with this sport and its amalgamation with their lives is an important issue (Yeh et al., 2008). More positive results have been reported from the studies conducted in Asian countries, especially China because this exercise is not strange to the elderly with Chinese background and is not in conflict with their lifestyle. While in Iran there is not enough awareness about this sport, which reduces the motivation of the elderly to start and pursue it. This lack of familiarity, made some elderly people think that these movements are useless or do not concentrate enough on the movements of this exercise. Old people living in elderly care centers think that they are worthless, feel themselves closer to death and can lose hope to live. This has led elderly residents of care centers to be considered as the most vulnerable group who experience a lot of stress (Naseh et al. 2014). These factors and continuous stress sometimes make them indifferent, unconcerned or disinterested to engage in activities. According to the study of Kim et al. (2016) on mental-attention effect of Tai Chi on older adults, this exercise should be repeated and practiced in non-familiar cultures, but it was not possible to do it in a privately managed elderly care center. Moreover, the elderly participants in our study did not concentrate enough on the movements of this exercise.

Tai Chi is a complementary therapy, in recent years, non-pharmacological methods have attracted the attention of patients and health care providers (Azimzadeh et al. 2013). In elderly nursing, since a holistic look and attention to all the needs of an elderly person is very much important; therefore, implementation of this exercise can promote the health of the geriatrics and find a clear or effective form for this sport in the elderly population.

One of the limitations of this research was lack of adequate open space for Tai Chi exercise. The research space had no suitable and safe sports hall for the elderly. During the intervention, the elderly who did not have the ability

to stand up, sat on the chair and made the movements according to their ability and an emphasis on increasing the upper extremity movement. It should be noted that during the exercise of elderly people, there was a chair near each elderly in order to be used in case of tiredness or imbalance. The care givers responsible for each participant in the elderly care centers had to be present near the elderly and help them in the risk of imbalance.

In this study, due to the type of research design (randomized quasi-experimental), generalization of the results of this study to a large extent is not possible; therefore, using the findings of this study should be done with caution.

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Conflict of Interest

The authors declare that they have no conflict of interest.

References

Askarifard, Gh. R., 2001. *[Elderly diseases* (Persian)]. Tehran: University of Social Welfare and Rehabilitation Sciences.

Azimzadeh, E., Hosseini, M., & Nourozi Tabrizi, K., 2013. [Effect of Tai Chi Chuan on quality of life in women with multiple sclerosis (Persian)]. *Hayat*. 19(2). pp. 1-13

Biglari, N., Arshadi, S., & Sadeghian, M. R., 2016. [The effect of 8 weeks Taichi Chouan training and walking on cardiovascular disease biomarkers in old women's (Persian)]. *Advances in Nursing & Midwifery*, 26(93), pp. 69-76.

Cohen, S., Kamarck, T. & Mermelstein, R., 1983. A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), pp. 385-96. [DOI:10.2307/2136404]

Hapunda, G. et al., 2015. Living with type 1 diabetes is challenging for Zambian adolescents: Qualitative data on stress, coping with stress and quality of care and life. *BMC Endocrine Disorders*, 15(1), pp. 2-12. [DOI:10.1186/s12902-015-0013-6]

Harrison, C., et al., 2017. *Medical and psychosocial aspects of chronic illness and disability*. Burlington: Jones & Bartlett Learning.

Jacob, L., Breuer, J. & Kostev, K., 2016. Prevalence of chronic diseases among older patients in German general practices. *GMS German Medical Science*, 14, pp. 1-7. [DOI:10.3205/000230]

Kim, T. H. M. et al., 2016. The mental-attention Tai Chi effect with older adults. *BMC Psychology*, 4(1), p. 29. [DOI:10.1186/s40359-016-0137-0]

Lan, C. et al., 2013. Tai Chi Chuan exercise for patients with cardiovascular disease. *Evidence-Based Complementary and Alternative Medicine*, 2013, pp. 1-9. [DOI:10.1155/2013/980208]

Lee, Y. M., 2017. The effects of Tai Chi on waist circumference and blood pressure in the elderly. *Journal of Physical Therapy Science*, 29(1), pp. 172–5. [DOI:10.1589/jpts.29.172]

Lloyd Sherlock, P. et al., 2014. Hypertension among older adults in low- and middle-income countries: prevalence, awareness and control. *International Journal of Epidemiology*, 43(1), pp. 116–28. [DOI:10.1093/ije/dyt215]

Miller, S. M. & Taylor Piliae, R. E., 2014. Effects of Tai Chi on cognitive function in community-dwelling older adults: A review. *Geriatric Nursing*, 35(1), pp. 9–19. [DOI:10.1016/j.gerinurse.2013.10.013]

Naseh, L., Shaikhy, R., & Rafii, F., 2014. [Quality of life and its related factors among elderlies living in nursing homes (Persian)]. *Iran Journal of Nursing*, 27(87), pp. 67-78.

Pho, A. T. et al., 2012. Nursing strategies for promoting and maintaining function among community-living older adults: The CAPABLE intervention. *Geriatric Nursing*, 33(6), pp. 439–45. [DOI:10.1016/j.gerinurse.2012.04.002]

Rasel, M., Ardalan, A., 2007. [The future of ageing and its health care costs: A warning for health system (Persian)]. *Salmand*, 2(2), pp. 300-5.

Sato, S. et al., 2010. Effect of Tai Chi training on baroreflex sensitivity and heart rate variability in patients with coronary heart disease. *International Heart Journal*, 51(4), pp. 238–41. [DOI:10.1536/ihj.51.238]

Taylor Piliae, R. E., 2014. Tai Ji Quan as an exercise modality to prevent and manage cardiovascular disease: A review. *Journal of Sport and Health Science*, 3(1), pp. 43–51. [DOI:10.1016/j.jshs.2013.09.002]

Vahedian Azimi, A., et al., 2012. [The relationship between perceived stress and the top five heart disease characteristics in patients with myocardial infarction (Persian)]. *Journal of Zanjan University of Medical Sciences*, 20(78), pp. 100-12.

Yeh, G.Y. et al., 2008. The effect of Tai Chi exercise on blood pressure: A systematic review. *Preventive Cardiology*, 11(2), pp. 82–9. [DOI:10.1111/j.1751-7141.2008.07565.x]

Zimmerman, M. E. et al., 2016. Perceived stress is differentially related to hippocampal subfield volumes among older adults. *PLOS ONE*, 11(5), p.e0154530. [DOI:10.1371/journal.pone.0154530]

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Trials

STUDY PROTOCOL Open Access

Effects of taichi on grade 1 hypertension: A study protocol for a randomized controlled trial

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Abstract

Background: Medication is generally recommended to reduce the morbidity and mortality caused by cardiovascular disease in hypertensive patients. However, considering the difficulties and economic factors associated with long-term medication, interest in taichi as an exercise treatment method has increased recently in Korean medical practice. Numerous studies have suggested that taichi can be used to treat various diseases and that is can affect psychosomatic factors such as anxiety. This study aims to evaluate the effect of taichi in reducing blood pressure among grade 1 hypertensive patients.

Methods/design: In this randomized, active-controlled, assessor-blinded, two parallel-armed trial, 80 grade 1 hypertension patients will be recruited and randomly assigned to the usual care group or to the taichi group (n = 40 in each group). Subjects who voluntarily sign a study agreement will be educated in managing their own blood pressure by restricting salt intake, losing weight, moderating alcohol consumption, performing exercise, and regulating dietary intake at their first visit. In addition to self-management, the taichi group will perform two 60-min taichi sessions per week for a total of 8 weeks. Blood pressure will be measured as the primary outcome. In addition, body composition, heart rate, and the perceived intensity and difficulty of the exercise will be measured as secondary outcomes.

Discussion: This study is a randomized controlled trial of taichi, which is not widely practiced in Korea. It may provide valuable data on the effects of taichi on hypertension, which will inform non-pharmaceutical treatment options for this disorder.

Trial registration: Clinical Research Information Service, KCT0003632. Registered on 18 March 2019.

Keywords: Hypertension, Taichi, Taichichuan, Taijiquan, Martial arts, Blood pressure

Background

According to the Korea National Health and Nutrition Examination Survey (2015), the prevalence of hypertension is 27.9% in Korea, and 36.8% of Korean adults belong to the pre-hypertension category [1]. The prevalence of age-related hypertension was 52.1% in males and 51.5% in females aged 60–69 years, and 61.7% in males and 71.3% in females aged 70 years or older [1]. The higher prevalence in older patients is because age-related reductions in blood vessel elasticity increase the systolic blood pressure (SBP) and decrease the diastolic blood pressure (DBP) [2]. If blood pressure is not controlled, blood vessel damage will occur and lead to the complications of hypertension [2]. If hypertension is not detected early and treated properly, it can lead to complications such as myocardial infarction, stroke, and kidney failure [3].

The goal of controlling hypertension is to reduce the morbidity and mortality caused by cardiovascular disease by maintaining normal blood pressure [4, 5]. Medication for hypertension is generally recommended for SBP

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greater than 140 mmHg in patients younger than 60 years of age or DBP greater than 90 mmHg regardless of age [6]. However, considering the side effects and economic factors associated with long-term medication, non-medication approaches, such as eating healthily, exercising, ceasing smoking, and moderating alcohol consumption, are widely used to treat and manage hypertension along with pharmacotherapy [7]. In particular, Parker et al. [8] reported that physical activity, including moderate-intensity exercises such as walking or home exercise, reduced the blood pressure in incident hypertension after 15 years of follow-up.

In recent years, there has been increasing interest in taichi as an exercise treatment method for various diseases [9–15]. According to a study conducted by Kim [16], taichi may lower sympathetic tone and increase parasympathetic tone, which may result in changes in the autonomic nervous system. In addition, a randomized controlled study conducted by Tsai et al. [17] suggested that a 12-week period of taichi exercise reduces blood pressure, as well as lipid levels, and improves patient anxiety.

In this study, we analyze the blood pressure, heart rate, and body composition of grade 1 hypertension patients who have been diagnosed during a medical examination in a hospital or had an SBP of 140–159 mmHg or DBP of 90–99 mmHg in a screening test. We will evaluate the effectiveness of taichi by comparing the control of hypertension in a group practicing usual care with that in an experimental group practicing usual care plus taichi. The effectiveness of taichi for hypertension will, thus, be assessed in this randomized, active-controlled, assessor-blinded, two parallel-armed trial.

Methods/design

Study design

The proposed study is a randomized, active-controlled, assessor-blinded, two parallel-armed trial. It will be conducted at Pusan National University Korean Medicine Hospital (PNUKH) in Yangsan, Korea. The study protocol was approved by the institutional review board (IRB) of PNUKH on 16 January 2019 (approval number 2018014) and was registered in the Clinical Research Information Service on 18 March 2019 (KCT0003632). Table 1 is the schedule of enrollment, intervention, and assessments. Table 2 lists all relevant items in the World Health Organization's trial registration data set.

Participants

Inclusion criteria

To be included, patients must meet all the inclusion criteria:

- They must have been diagnosed with grade 1 hypertension during a health checkup or at the hospital, have SBP of 140 to 159 mmHg, or have DBP of 90 to 99 mmHg.
- They must understand the study procedures and should be able to follow the advice given
- They must sign the study agreement and voluntarily agree to participate in the study

Exclusion criteria

People who meet any of the exclusion cannot participate in the trial, that is

- If they have participated in another trial within a month before this study.

Table 1 Schedule of enrollment, intervention, and assessments

Measure	Screening (week 0)	Active treatment								Follow-up (12 weeks after screening)[†]
		Week 1	Week 2	Week 3	Week 4 (visit 1)[†]	Week 5	Week 6	Week 7	Week 8 (visit 2)[†]	
Study agreement	X									
Check for participation in other clinical trials	X									
Sociodemographic characteristics[‡]	X									
Taichi exercises		Two sessions per week								
Body composition test	X								X	X
Measurement of vital signs[§]	X				X				X	X
Intensity and difficulty of exercises									X	
Number of taichi sessions attended										X
Adverse events					X				X	X

† ±3 days
[‡]Age, gender, occupation, past history, present illness, and medications
[§]Blood pressure (systolic and diastolic), heart rate, and body temperature

Table 2 All relevant items in the World Health Organization's trial registration data set

Data category	Information
Primary registry and trial identifying number	Clinical Research Information Service, KCT0003632
Date of registration in primary registry	18 March 2019
Secondary identifying numbers	Not applicable
Source(s) of monetary or material support	Traditional Korea Medicine R&D program of Korea Health Industry Development Institute
Primary sponsor	Wonkwang University
Secondary sponsor(s)	Not applicable
Contact for public queries	Man-Suk Hwang, + 82–55–360-5970, hwangmansuk@pusan.ac.kr
Contact for scientific queries	Man-Suk Hwang, Department of Rehabilitation Medicine of Korean Medicine, Spine and Joint Center, Pusan National University Korean Medicine Hospital, 20, Geumo-ro, Mulgeum-eup, Yangsan-si, Gyeongnam 50612, Republic of Korea.
Public title	Effects of taichi on grade 1 hypertension: A study protocol for a randomized controlled trial
Scientific title	The Effects of Taichi on Grade 1 Hypertension: Randomized controlled trial
Countries of recruitment	Republic of Korea
Health condition(s) or problem(s) studied	Hypertension
Intervention(s)	Taichi
Key inclusion and exclusion criteria	Inclusion Criteria o Patients must have been diagnosed with grade 1 hypertension during a health checkup or at the hospital, have SBP of 140 to 159 mmHg, or have DBP of 90 to 99 mmHg. o Patients who understand the study procedures and are able to follow the advice given o Patients must sign the study agreement and voluntarily agree to participate in the study Exclusion Criteria o Patients who have participated in another trial within a month before this study. o Patients whose high blood pressure is deemed by a doctor as too difficult to treat with exercise because of conditions such as severe pain or joint deformation. o Patients who are unable to communicate properly, for example due to dementia or mild cognitive impairment. o Patients who are pregnant. o Patients who should not be included in this study based on the investigator's judgment.
Study type	Type of Study: Interventional Method of allocation: Randomized Masking: Outcome assessor blinding Assignment: Two-parallel armed, active controlled
Date of first enrollment	17 April 2019
Target sample size	1. Number of patients that the trial plans to enroll in total: 80 2. Number of patients that the trial has enrolled: 19
Recruitment status	Recruiting
Primary outcome(s)	Blood pressure, which will be measured at baseline, prior to each hospital visit, and during the follow-up visit
Key secondary outcomes	Body composition, which will be measured at baseline, week 8, and at the follow-up visit Heart rate, which will be measured at baseline, prior to each visit, and during the follow-up visit Intensity and difficulty of the exercises, which will be assessed once, at the end of the exercise training.
Ethics Review	1. Status: Approved 2. Date of approval: 16 January 2019 3. Name and contact details of Ethics committee: Pusan National University Korean Medicine Hospital IRB (approval number: 2018014), 20, Geumo-ro, Mulgeum-eup, Yangsan-si, Gyeongnam 50612, Republic of Korea. + 82–55–360-5902
Completion date	15 January 2020
Summary results	Not applicable: protocol
Individual patient data sharing statement	1. Plan to share individual patient data: Decided 2. Plan description: The datasets used or analyzed during the study can be requested from the corresponding author

- If their high blood pressure is deemed by a doctor as too difficult to treat with exercise because of conditions such as severe pain or joint deformation.
- If they are unable to communicate properly, for example due to dementia or mild cognitive impairment.
- If they are pregnant.
- If they should not be included in this study based on the investigator's judgment.

Discontinuation and dropout criteria

Participants will be withdrawn from the study:

- If they are found to have a previously undiagnosed severe disease after enrollment and before the start of the clinical trial.
- If they have another disease (except hypertension) that may influence the results of the trial.
- If they miss two consecutive assessment visits.
- If they ask to be withdrawn from the trial.
- If they are lost to follow-up.

Recruitment

Patients will be recruited using advertisements on the bulletin boards of Pusan National University Yangsan Hospital (PNUYH) and PNUKH, at local public health centers, and at other local government offices. Patients who are interested in participating will first be screened to determine their eligibility. Eligible patients will receive an explanation of the study and can voluntarily decide whether they wish to participate. If the patient consents to the study terms, a clinical research coordinator (CRC) will check whether they are suitable in accordance with the inclusion and exclusion criteria. Then, the patient will be assigned randomly to the taichi group or the usual care group. After allocation, the CRC will schedule their treatment procedure. The first participant was enrolled on 17 April 2019.

Randomization

A statistician who is not involved in conducting or assessing the clinical trial will generate a randomization sequence using the statistical program SAS®, Version 9.4 (SAS institute. Inc., Cary, NC). Using the sequence, the statistician will prepare 80 sealed envelopes, 40 of which will contain an A and 40 a B based on blocked randomization. Once a participant has signed the informed consent form, the CRC will open the next envelope in the sequence and inform the practitioner of the participant's assignment to the experimental group or the usual care group (Fig. 1).

Blinding

Since blinding of the intervention is impossible, the group allocation will not be concealed and the participants will not be blind. Instead, the outcome assessor and data analyst will be blind to the allocation and they will not participate in recruitment or the intervention. The outcome assessor will assess participants at the study visits. The data analyst will analyze the statistical data to prevent selective reporting of outcome variables. Unblinding will be permitted only when it is necessary to reveal the participant's allocated intervention, such as in cases of severe side effects, at the discretion of the assessor.

Education levels of the practitioners

All the physicians participating in this study as practitioners or researchers are licensed by the Ministry of Health and Welfare of Korea and have at least one year of clinical experience in Korean medicine. These practitioners will be

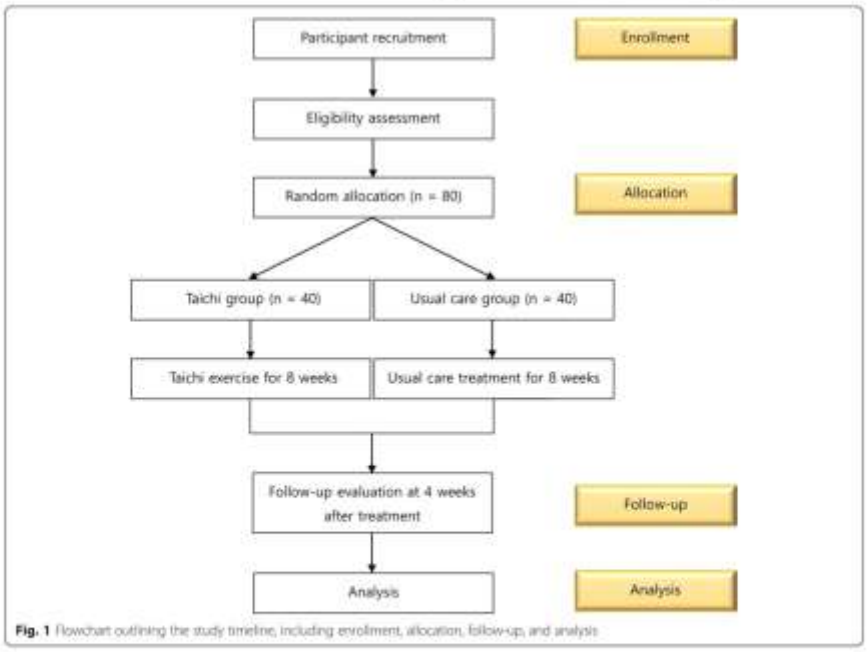

Fig. 1 Flowchart outlining the study timeline, including enrollment, allocation, follow-up, and analysis

adequately trained so that they closely adhere to the research protocols and are familiar with the research treatment methods. All the taichi educators have been trained as Korean rehabilitation medical trainees or specialists in taichi exercise and have at least one year of taichi experience. Among them, the research director of this study has more than ten years of taichi experience.

Intervention

At their first visit, patients in both groups will be educated in managing their own blood pressure by restricting salt intake, losing weight, moderating alcohol consumption, exercising, and regulating their diet. Additionally, patients in both groups will be asked not to do any intense exercise that could influence the results of the trial. After this education, the usual care group will self-manage their own blood pressure for 8 weeks.

In addition to self-management, the experimental group will perform taichi as the study intervention. The taichi used in this study is Chen-style 18-form taichi, which will be conducted over two 60-min sessions per week for a total of 8 weeks (80% compliance and more than 13 sessions in total). In each session, patients will perform 10 min of warm-up exercises, 40 min of taichi, and 10 min of cool-down exercises. To maximize adherence to the study protocol, the intervention will mostly be performed in the 6th floor ward at PNUKH. If group sessions are needed, the practitioners can visit external locations. The patients in the experimental group will receive a reference book on taichi that will promote their retention of the exercises. A daily log will record how many exercises each patient has conducted. At weeks 4 and 8, both groups will visit the hospital for an assessment. After treatment, both groups will be monitored for an additional 4 weeks of follow-up.

Outcome assessment

At the initial screening visit, the CRC will explain the study protocol to the patient. Then, the participants will be asked about their sociodemographic characteristics, including age, gender, occupation, past history, present illness, and medications, at an isolated room for allocation concealment. All adverse events will be recorded, and the practitioners will check the severity of the events and decide the continuance of the trial. Follow-up assessments will be performed once at 12 weeks after the initial screening visit (Table 1, Fig. 1).

Primary outcome measurements

Blood pressure will be the primary outcome of this trial. The CRC will assess the participant's blood pressure in a stable state using an automatic electronic blood pressure monitor (HBP-1300, Omron Dalian Co., Ltd., China). To obtain accurate data, the measurements will be conducted three times and their mean value will be used as the outcome. Blood pressure will be measured at baseline (assessment 1), prior to each of the visits (assessments 2 and 3), and during the follow-up visit (assessment 4). The primary endpoint is week 8 (assessment 3).

Secondary outcome measurements

Body composition is one of the secondary outcomes of this trial. The body composition test assesses each participant's weight, body fat mass, body mass index, percentage of body fat, and weight-to-hip ratio. The participant will stand barefoot on the Inbody body composition analyzer (Inbody 770; Inbody Co., Ltd., South Korea). After their weight has been measured, the participant will grasp the handles and the machine will pass multifrequency signals through their body to obtain the impedance corresponding to each frequency. Using these measured impedance values, the machine will calculate how much body fat they have. The test will be conducted at baseline (assessment 1), week 8 (assessment 3), and at the follow-up visit (assessment 4).

Heart rate is another secondary outcome of this trial. The heart rate of participants will assessed when they are in a stable state at the same time as their blood pressure is measured. Thus, measurements will be conducted at baseline (assessment 1), prior to each of the visits (assessments 2 and 3), and during the follow-up visit (assessment 4).

The intensity and difficulty of the exercises are also secondary outcomes. The aim is to compare their subjective assessment of the intensity of the exercise with its absolute intensity. The experimental group will be asked four questions.

1. Was this exercise routine easy to follow?
2. Is taichi useful for improving your health?
3. Was the taichi conducted at appropriate time for you?
4. Is the reference book helpful for performing taichi on your own?

Participants will answer each question using a 0 to 10 category scale.

They will rate the difficulty of the taichi exercises using a 0 to 10 visual analog scale, on which 0 indicates no difficulty and 10 indicates the maximum possible difficulty the person can imagine. Both surveys will be conducted once at the end of the final taichi session. Thus, the measurement point will be week 8 (assessment 3).

Sample size

This study took into account the results of a previous study [18] that used taichi as the main evaluation index. The calculated sample size necessary for the *t*-test was 36 subjects in each group, which was conducted with a

G power analysis with an effect size of 0.67, test power of 0.80, and significance level of 0.05. Considering a dropout rate of 10%, we aim to recruit a total of 40 subjects in each group.

Statistical analysis plan

Continuous variables will be expressed as mean ± standard deviation, and categorical variables will be expressed as *n* (%). The demographic baseline information (age, gender, occupation, past history, present illnesses, and medications) will be tested using the chi-squared test and independent *t*-test.

As the primary statistical analysis, the effectiveness of taichi will be tested by calculating the differences in the maximum SBP and minimum DBP before (baseline) and after (week 8) treatment for each test subject. Comparisons of the within-group differences will be performed using a paired *t*-test and between-group differences using an independent *t*-test. If the data do not have a normal distribution, they will be tested using a nonparametric test (a Wilcoxon signed-rank test or Wilcoxon rank-sum test).

The heart rate and the body composition of the participants will be tested to verify the effectiveness of taichi by calculating the difference between before (baseline) and after (week 8) the treatment as described above.

The results of the questions regarding the intensity and difficulty of the exercises will be evaluated by the researchers, and the numerical value will be analyzed by a simple descriptive statistical method. We will perform a simple correlation analysis or simple regression analysis to determine whether there is a correlation between the differences in blood pressure and the intensity and difficulty of the exercise as perceived by the experimental group.

Information regarding adverse events will be collected through patient reports and researchers' observations. The frequency of adverse events will be analyzed by a chi-squared test or Fisher's exact test.

All statistical analyses will be conducted in a two-sided manner, with a significance level of 5%. In addition, we will use an intention-to-treat analysis for missing data in the primary and secondary analyses. The last-observation-carried-forward and multiple imputation, which are widely used in clinical research, will be applied to missing data and additional multiple imputation or regression analysis will be used to check any differences.

Safety

Because the intervention is a simple exercise rather than untested drugs or medical devices, we do not expect any adverse events will be caused by the general Korean medical treatment. However, the investigators will inform the participants of all possible adverse events that may occur after taichi and instruct them to report any such adverse events. All adverse events recorded during the research period will be analyzed and reported. In general, due to the interventional characteristics of exercise, simple muscular pain may occur. We will provide beverages such as bottled water or green tea during the exercise sessions for the participants. To prevent falls and severe muscle aches, a chair will be available during exercise sessions. There will also be a space where participants can sit and relax. If a direct injury occurs in connection with this study, appropriate medical action may be taken, as determined by the investigator.

A data monitoring committee (DMC) comprising members of staff from the clinical research service institution (Woosuk University) will periodically monitor the study by telephone, e-mail, and visits, if necessary. The DMC will be composed of one statistician and one specialist in clinical research methodology. They will review the progress of the study and check all case report forms. In addition, they will check whether the study has followed the study protocol. If a problem is identified, the DMC will modify the protocol if necessary. If modifications to the protocol are required during the study, the modified protocol will be submitted by the clinical trial review committee to the IRB for approval. However, neither auditing nor an interim analysis are planned during the trial.

Additionally, as we will not collect any biological samples and do not intend to use the participants' data in future studies, we do not need any additional consent for collection and use of participant data or biological specimens in ancillary studies. In accordance with government regulations and standards, all documents related to the conduct of a clinical trial must be kept by the director of clinical research, or the director of the institution and the clinical research manager, for at least 3 years after the completion of the clinical trial.

Ethics and dissemination

As this clinical study was prepared with patient rights and well-being in mind based on the Declaration of Helsinki, the clinical researchers will follow the research plan and will actively respond to any problems raised by the participants. Additional file 1 contains a completed SPIRIT checklist.

Before patients are asked to participate in this clinical study, the researchers will explain to them all the details of the research. They must voluntarily agree to participate in the research. The English initials of the names of the participants in the trial will be recorded and identifying information will be managed using a subject identification code list to prevent personal information, such as social security numbers, from being leaked. Other researchers and research organizations will be able to view the clinical research data collected during reviews by the DMC, IRB inspections and assessments, and government

surveys. On completion of the trial, the researchers will consult with the clinical research service institution (Woosuk University) to prepare a report of this study. The study findings will be disseminated in peer-reviewed journals and presented at national and international conferences. Additionally, we will share deidentified individual patient data. The datasets used or analyzed during the study can be requested from the corresponding author.

Discussion

When searching for research conducted in Korea into the effects of taichi on blood pressure, we found studies that assessed the effects of taichi on waist circumference and blood pressure of the elderly [18] and the effect of taichi on the cardiac autonomous nervous system and blood pressure of elderly women [16]. These studies on taichi mainly had elderly participants. In addition, in a systematic review by Hwang et al. [19], only randomized controlled trials from China, Italy, United Kingdom, USA, Hong Kong, and Taiwan were analyzed, and no randomized controlled trials from Korea were included.

A major limitation of this study is that the participants cannot be blinded due to the nature of the intervention. Because the experimental group has to perform taichi, the participants will know whether they belong to the experimental group or the comparator group. This knowledge may affect the results of the study by influencing other behaviors, which may, thus, differ between the groups.

A strength of this study is that it will evaluate the effects of taichi in ordinary adults aged 19 to 70 years instead of being limited to the elderly. In addition, this study is a randomized controlled trial of taichi, which is not widely practiced in Korea. Taichi is easy to perform and not strenuous, so it can easily be practiced at home by almost anyone. As a result, this study may provide valuable data on the effects of taichi on hypertension.

Trial status

The current protocol is version 1.7, dated 28 November 2019. Recruitment began on 17 April 2019. The approximate completion date for recruitment is in April 2020. This trial was prospectively registered before recruitment began.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s13063-019-4028-6.

Additional file 1. SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents.

Abbreviations

CRC: Clinical research coordinator; DBP: Diastolic blood pressure; DMC: Data monitoring committee; IRB: Institutional review board; PNUKH: Pusan National University Korean Medicine Hospital; PNUYH: Pusan National University Yangsan Hospital; SBP: Systolic blood pressure

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Authors' contributions

SHL designed the study and drafted the manuscript. EJJ planned the statistical strategy. EJP was actively involved in the sample size calculation and random allocation. EHH is the principal investigator at the hospital and, along with BJK, will teach the patients taichi. As investigators at the hospital, HIP, BJK, and MSH were involved in the study design and IRB approval. EJJ and MSH are the principal investigators of the overall research project and have the final responsibility for publication. All authors have read, revised, and approved the final version of the manuscript.

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This study was supported by the Traditional Korean Medicine Research & Development program funded by the Ministry of Health & Welfare through the Korea Health Industry Development Institute (HB16C0023). This funding source had no role in the design of the study and will not have any role during collection, management, analysis, interpretation of data, writing of the report, and the decision to submit the report for publication.

Availability of data and materials

The datasets used or analyzed during the study can be requested from the corresponding author.

Ethics approval and consent to participate

This study has been approved by the IRB of PNUKH (approval number 2019R014). All participants must sign the latest version of the informed consent form approved by the IRB. This trial has been registered at the Clinical Research Information Service (KCT0003632), which is one of the World Health Organization's International Clinical Trials Registry Platforms. If protocol modifications are necessary, they will be reported to the IRB. The personal information of subjects will be kept secret and will be processed anonymously.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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References

1. Ministry of Health & Welfare DoHP. Korea National Health and Nutrition Examination Survey; 2016. p. 50.
2. Mosley WJ II, Lloyd-Jones DM. Epidemiology of Hypertension in the Elderly. Clin Geriatr Med. 2009;25(2):179–89.
3. Turgut F, Yesil Y, Balogun RA, Abdel-Rahman EM. Hypertension in the elderly: unique challenges and management. Clin Geriatr Med. 2011;27(3):593–609.
4. Carlberg B, Nilsson PM. Hypertension in the Elderly: What is the Goal Blood Pressure Target and How Can This Be Attained? Curr Hypertens Rep. 2010;12(5):331–4.

5. Hartley L, Flowers N, Lee MS, Ernst E, Rees K. Tai chi for primary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2014;4:Cd010366.
6. Nilsson PM. Blood pressure strategies and goals in elderly patients with hypertension. Exp Gerontol. 2017;87:151–0.
7. Mahmood S, Shah KU, Khan TM, Nawaz S, Rashid H, Baqar SWA, et al. Non-pharmacological management of hypertension: in the light of current research. Ir J Med Sci. 2019;188(2):437–52.
8. Parker ED, Schmitz KH, Jacobs DR Jr, Dengel DR, Schreiner PJ. Physical activity in young adults and incident hypertension over 15 years of follow-up: the CARDIA study. Am J Public Health. 2007;97(4):709–9.
9. Ahn Y-J, Jo S-H, Lee S-H, Lim J-H. The review study on Yoga, Qigong, and Taichi Interventions for anxiety: Based on Korean journal articles from 2009 to 2015. J Oriental Neuropsych. 2016;27(1):23–31.
10. Ji HQ. The Effect of Taichi Exercise on Attention Concentration and Dynamic Balance in Children with ADHD [master's thesis]. Busan: Pusan National University; 2013.
11. Kim KL, Bae SJ, Seo HK. The Effect of Taichi on Health Related Fitness and Cognitive Function in Elderly Women with Dementia. J Kor Soc Rhythmic Exercises. 2018;11(2):51–8.
12. Kim Y-S, Park M-S, Kwak Y-S. 12-Week Taichi Exercise on Physical Fitness, Blood Pressure, and Cholesterol in Elderly Women. J Kor Soc Wellness. 2012;7(1):119–28.
13. Lee HY. The Effect of Taichi for Patients with Type 2 Diabetes - Analysis According to the Styles of Taichi Considering the Intensity: Systematic Review [master's thesis]. Busan: Pusan National University School of Korean Medicine; 2015.
14. Li F, Harmer P, Fitzgerald K, Eckstrom E, Stock R, Galver J, et al. Tai chi and postural stability in patients with Parkinson's disease. N Engl J Med. 2012;366(6):511–9.
15. Son JT, Hwang H. Comparison of Subjective Symptoms, Physical Fitness, Depression and Self-efficacy before and after Taichi in Patients with Rheumatoid Arthritis Based on 3 Years Data. J Muscle Joint Health. 2018;25(3):230–9.
16. Kim J-H. The Effect of Taichi Chuan Training on the Automatic Cardiac Nerve Activity and Blood Pressure in Elderly Women with Hypertension. J Kor Soc Dance Sci. 2014;31(1):157–68.
17. Tsai JC, Wang WH, Chan P, Lin LJ, Wang CH, Tomlinson B, et al. The beneficial effects of Taichi Chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial. J Altern Complement Med. 2003;9(5):747–54.
18. Lee YM. The effects of Taichi on waist circumference and blood pressure in the elderly. J Physical Therapy Sci. 2017;29(1):172–5.
19. Hwang E-H, Heo K-H, Lee G-S. Effect of Taichi as Therapeutic Exercise on Blood Pressure: Rapid Systematic Review. J Oriental Rehab Med. 2013;23(1):101–13.

Publisher's Note

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Article

Effect of Tai Chi Combined with Mental Imagery on Cutaneous Microcirculatory Function and Blood Pressure in a Diabetic and Elderly Population

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Abstract: The purpose of this study was to investigate the effects of Tai Chi (TC) training combined with mental imagery (MI) on blood pressure and cutaneous microcirculatory function in individuals with diabetes and age-matched healthy subjects. All subjects participated in a one-hour Yang style TC exercise with MI twice per week for 8 weeks. An activities-specific balance confidence (ABC) measurement, a single-leg stance (SLS), a functional reach test (FRT), systolic and diastolic blood pressure, and skin blood flow were assessed. All functional outcomes were significantly improved in both groups, and systolic and diastolic blood pressures were lower in both groups after the TC training ($p < 0.05$), but there was no significant group effect. Skin blood flow decreased in the age-matched elderly group when heat and occlusion were applied ($p < 0.05$), but no difference was found in the diabetes group. Combining TC with MI showed an improvement in functional outcomes and blood pressure but cutaneous microcirculatory function did not improve. Combining TC intervention with MI theory showed an improvement in functional outcomes and blood pressure, which showed cardiovascular benefits not only in diabetes but in age-matched healthy subjects. However, cutaneous microcirculatory function was increased only in age-matched healthy subjects.

Keywords: Tai Chi; mental imagery; diabetes; blood pressure; blood flow

1. Introduction

Diabetes is associated with numerous system impairments including loss of sensory function, especially in the extremities, reduced motor control, impaired blood flow to major organs, and impaired cardiovascular function. Impaired circulation is generally considered a major factor in the damage seen to most organ systems while glycosylation end-products can cause direct organ damage [1,2]. Diabetes can disrupt the autonomic nervous system and cause endothelial dysfunction and impairment of autonomic neurons [3,4]. This reduces functions in both the sympathetic and the parasympathetic nervous systems [5]. Lack of adequate circulation causes both damage to sympathetic neurons and their ganglia [6]. While autonomic impairment is often not seen in the patient at rest, in the presence of autonomic stressors the impairment is commonly observed in about 30% of patients with diabetes and especially when stressors are combined, such as heat exposure and orthostatic changes [7].

The vascular endothelium plays a major role in the regulation of vascular tone [8] and maintaining peripheral circulatory homeostasis [9]. Vasodilation is mediated through nitric oxide to provide increased blood supply proportional to the intensity of the exercise [8]. Endothelial dysfunction causes

either reduced nitric oxide release or oxidation of released nitric oxide, making it biologically inactive. Endothelial dysfunction has been shown to be highly correlated with cardiovascular risk factors such as diabetes mellitus, high blood pressure (hypertension), and aging [10,11].

Tai Chi (TC) is a form of traditional exercise practiced in China to maintain optimal health. Because of the complexity of the exercise, the subject must concentrate intensely in each sequence of the intricate movements, which helps to facilitate and enhance the peripheral circulation. Diabetes and aging can affect the peripheral circulation and blood pressure [9–11]. In TC, subjects in a mediation state try to shift weight from side to side using slow movements and while concurrently concentrating and visualizing each sequence of the movement. This helps to enhance the circulation and the autonomic control of blood pressure [12,13]. MI is defined as "the mental representation of movement without any movement" [14]. In this process, the subject uses his memory, without actually performing any movements, to understand the sequence of the movement. Then, the subject repeats the memorized movements to actually perform the movement. This helps to use muscles efficiently and to enhance peripheral circulation [12,13].

Previous studies have supported the role of motor or mental imagery (MI) for relearning or re-conditioning [14,15]. Many studies have shown that TC has positive results in elderly people for improving circulation [16–18] and lowering blood pressure [19,20]. A previous study demonstrated that TC practitioners who practice TC for years had higher cutaneous microcirculatory function during exercise than subjects who did not practice TC exercises [16]. With sustained practice of TC, some studies have shown positive effects of TC on controlling blood pressure [20,21].

While some studies have examined MI with TC, it has not been examined in people with diabetes. The purpose of this study was to investigate the effects of TC training, combined with MI, on improving blood pressure and peripheral cutaneous microcirculatory function in people with diabetes and in an age-matched healthy subject. While TC has been investigated in this population, it has not been investigated combined with MI.

2. Materials and Methods

2.1. Study Population

This study was approved by the Institutional Review Board (IRB) at Loma Linda University (LLU) (IRB approval # 5110209) and conducted at the Physical Fitness Laboratory at the School of Allied Health Professions (SAHP), Department of Physical Therapy. Subjects were recruited from the Drayson Fitness Center and the Diabetes Treatment Center at LLU. Study flyers were placed on the main bulletin board of the School of Allied Health Professions and the Drayson Fitness Center (main gym) in LLU. This flyer was also sent via email to all faculty and students in the SAHP. The Diabetes Treatment Center at LLU assisted by referring interested diabetic patients to the study research team and providing them with the study flyer if they felt they met the study criteria.

All subjects read and signed the informed consent form before they began the study. Forty individuals with diabetes and healthy non-diabetics between the ages of 50 to 80 years old participated in this study (20 with type 2 diabetes and 20 non-diabetes counterparts). They had normal or controlled blood pressure in the range between 150/90 and 90/60. None had practiced TC in the last 4 months, and none exercised more than once per week. Subjects were excluded if they did not have normal or controlled blood pressure or a normal range of motion and muscle strength. They were excluded from the study if they: (1) took medications that could affect balance; (2) had a history of frequent falling; (3) had vision problems or orthopedic/neuromuscular/cardiovascular impairments that restricted exercise.

2.2. Measurements

Subjective balance confidence when performing mobility tasks was measured using a 16-item activities-specific balance confidence (ABC) scale [22,23]. A score of zero represented no confidence at all and a score of 100 represented full confidence.

The functional reach test (FRT) was used to assess dynamic balance [24]. A one-meter-long stick was placed at shoulder level for the subjects so that they could lean forward with their dominant shoulder at 90 degrees and the extent of their reach could be assessed. The maximum reaching point of the third metacarpal was recorded. The subject was asked to repeat the measurement once they could ensure performing the test correctly.

A single-limb stance (SLS) test was performed to assess static balance [25,26]. The subject was asked to stand on one leg about 6 inches off the floor with eyes open and arms on the hips. Time was recorded while subject was maintaining balance.

The glycated hemoglobin A1C (HbA1C) blood test measuring the average concentration of blood glucose over a 3-month period is the most common outcome measure for glucose control. Approximately 5 µL of blood was obtained and used to measure the HbA1C level with a Food and Drug Administration (FDA) approved device, DCV Vantage Analyzer (SIEMENS®, Tarrytown, NY, USA). Since the HbA1C test is not affected by eating, blood samples for this test was taken without regard to when food was last eaten.

Skin blood flow was measured using a MOOR Laser Doppler Imager (Moor LTD, Oxford, UK). The laser was in single spot mode; the spot, which was left on the skin and the reflected energy, was used to measure the skin blood flow.

Blood pressure was measured using an Omron 7 Series electronic sphygmomanometer (OMRON Healthcare, Kyoto, Japan). The measurement was taken after rest for 15 min to avoid any confounding factors.

2.3. Intervention

A certified TC instructor conducted the class for the entire program. We found that the Yang-style TC was the best to use here because it comprised important characteristics relevant to MI and to somatosensory enhancement. The symmetrical Yang Style Form consisted of choreographed techniques including: Ward-off, grasping a Sparrows Tail, Single Whip, Dragon rolls around, white crane spreads wings, Brush the knee. The physical exercise involves various types of movement including postural control, weight shifting, correct postural mal-alignment, and slow coordinated movements with synchronized deep breathing. The exercise was conducted on a thick mat and with shoes off for greater sensory enhancement and challenge. Subjects were instructed to execute and feel the movement sequence while they visually observed themselves in front of a mirror. Supervision from the instructor was provided to correct any errors in movement if needed to achieve better outcomes. Then, subjects were asked to concentrate on the sequence of each movement of the TC and memorize the exercise visually from the TC instructor before they executed any movement. The exercise was conducted over a thick mat and without shoes to allow greater sensory enhancement and challenge [27,28].

Subjects were asked to participate in 1-hour TC exercise sessions twice per week for 8 weeks. Each session consisted of 15 min of warm-up and 45 min of TC Yang-style technique teaching, and the remainder practicing the activity for the duration of the class.

2.4. Procedures

Subjects were asked to rest for 15 min to achieve resting status and HbA1C blood was assessed for the diabetic group only. Then, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were measured. Baseline measurements were taken to assess functional data using the following tools: (1) the ABC Scale, (2) the SLS test, and (3) the FRT. For skin blood flow measurements, a thermode was

applied to the lower extremity to warm the skin for 6 min after the baseline skin blood flow was taken for a minute. Then, occlusion was applied using a blood pressure cuff inflated to 200 mmHg for 4 min followed by 3 min of additional blood flow recording.

2.5. Sample Size Estimation

To determine the sample size, the G-power 3.1.9 software (Heinrich-Heine-University Dusseldorf, Dusseldorf, Germany) was used. To calculate the sample size, the probability of alpha error and power were set at 0.05 and 0.8, respectively with. In addition, the effect size was set at 0.25 based on Cohen [29]. Therefore, a sample size of 17 subjects per group was necessary. By estimating a drop-out rate of about 10%, 20 subjects per group needed to be recruited.

2.6. Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA). The demographic characteristics of the subjects were compared between the diabetic and healthy subjects using the independent *t*-test for the quantitative variables and the Chi-square test for categorical variables. The normality of the outcome variables was measured using the Shapiro–Wilk Test. Since FRT was normally distributed Independent *t*-test was used to compare between groups, and a paired *t*-test was used to compare between pre and post intervention in each group. The baseline scores and differences between pre- and post-measures of ABC and SLS were compared between the two groups using the Mann–Whitney *U* test. The Wilcoxon Signed rank test was used to compare functional outcomes between pre- and post-intervention in each group.

In each study group, comparisons between pre- and post-blood pressure measures after the TC exercise were assessed using a paired *t*-test. The changes in blood flow for the different times when exposed to heat, and in the presence or absence of occlusion, were assessed using a paired *t*-test. The level of significance was set at $\alpha = 0.05$.

3. Results

Twenty-nine subjects completed the study (12 diabetics and 17 healthy subjects). Eleven participants did not complete the study due to conflicts with the TC class schedule. The general characteristics of the participants are shown in Table 1.

Table 1. Demographic characteristics of participants ($N = 29$).

Characteristic	Diabetic ($n = 12$)		Healthy Subjects ($n = 17$)		*p* Value [a]
	Mean (SD)	*n* (%)	Mean (SD)	*n* (%)	
Age (years)	63.8 (8.1)		63.6 (6.5)		0.91
Gender (Female)		8 (66.7)		13 (76.5)	0.43
Weight (Kg)	86.8 (17.2)		77.4 (17.4)		0.16
Height (m)	1.8 (0.1)		1.7 (0.1)		<0.01
BMI (Kg/m^2)	27.9 (5.5)		27.1 (4.3)		0.66
Duration of diabetes (years)	10.8 (5.4)				
HbA1C	6.8 (0.8)				

Abbreviation: SD, standard deviations; BMI, body mass index. [a] *p* value from independent *t*-test.

The mean ABC score improved significantly in both groups ($p < 0.01$), but no significant difference between the two groups was found ($p = 0.17$). Similar findings were observed for the FRT and the SLS test. In both groups, the mean FRT distance significantly increased after the 8 weeks of TC exercise compared to baseline ($p < 0.01$), but this difference was not significant between the two groups ($p = 0.91$). In addition, a significant increase was found in the mean SLS in both groups ($p < 0.01$), but no significant difference was observed between the two groups ($p = 0.17$). (Table 2).

Table 2. Changes in activities-specific balance confidence (ABC), functional reach test and single-limb stance test in diabetic (n = 12) and healthy subjects (n = 17).

Tool	Group		Median [Min, Max] Mean (SD)	Pre-Post p Value	Between Group p Value
ABC	Diabetic	Pre Post	88.8 [45.6, 95.6] 95.0 [75.6, 99.7]	<0.01 [a]	0.17 [b]
	Healthy Subjects	Pre Post	95.0 [87.3, 100.0] 96.9 [92.5, 100.0]	<0.01 [a]	
Single Limb Stance	Diabetic	Pre Post	11.0 [2.0, 133.0] 25.1 [4.7, 198.0]	<0.01 [a]	0.17 [b]
	Healthy Subjects	Pre Post	28.0 [4.3, 127.0] 57.3 [11.3, 168.0]	<0.01 [a]	
Functional Reach Test	Diabetic	Pre Post	11.2 (1.6) 12.8 (2.2)	<0.001 [c]	0.91 [d]
	Healthy Subjects	Pre Post	11.7 (1.8) 13.3 (1.7)	<0.01 [c]	

Abbreviation: SD, standard deviation; Min, minimum; Max, maximum; [a] p value from Wilcoxon signed rank test; [b] p value from Mann–Whitney U test; [c] p value from Paired t-test. [d] p value Independent t-test.

The determinations of skin blood flow across the two experimental conditions are shown in Table 3 and in Figures 1 and 2. These figures illustrate the average skin blood flow recorded for a 6-minute exposure to heat and then after heating, and for 3 min after the occlusion of the circulation for 4 min. The response to heat is a measure of nitric oxide production by the skin since the vasodilation due to heatmediated by nitric oxide. The occlusion protocol measures vascular endothelial function.

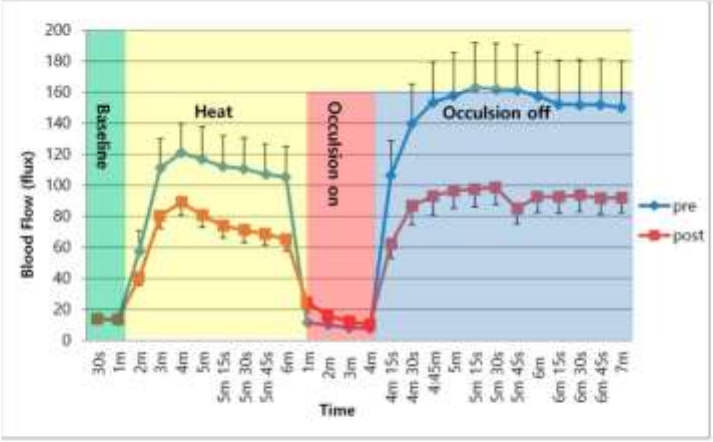

Figure 1. Mean and SD of Skin blood flow over time between pre- and post-intervention in healthy subjects.

Table 3. Mean (SD) of skin blood flow at pre- and post-intervention over the time in diabetes (n = 12) and healthy subjects (n = 17).

		Time	Diabetic (n = 12)		Healthy Subjects (n = 17)	
			Pre	Post	Pre	Post
Baseline		30 s	13.1 (2.3)	12.6 (1.8)	14.0 (1.7)	13.7 (1.3)
Heat	Heat On	1 m	13.1 (1.8)	13.9 (2.1)	12.9 (1.7)	13.5 (1.3)
		2 m	29.4 (2.5)	36.3 (5.9)	57.5 (13.5)	40.6 (5.1)
		3 m	62.7 (6.0)	61.2 (9.6)	111.2 (18.9)	80.2 (7.8)
		4 m	67.3 (7.9)	73.9 (16.0)	120.9 (18.3)	89.1 (8.5)
		5 m	62.2 (10.0)	65.8 (17.3)	116.8 (20.7)	80.7 (7.8)
		5 m 15 s	60.5 (10.2)	62.5 (16.7)	112.1 (19.9)	73.9 (7.7)
		5 m 30 s	62.5 (16.7)	56.8 (9.5)	110.6 (20.0)	71.1 (7.9)
		5 m 45 s	59.1 (16.6)	56.3 (8.9)	107.0 (19.5)	68.5 (7.2)
		6 m	56.3 (8.9)	58.9 (17.5)	105.2 (19.6)	65.2 (7.8)
	Occlusion On	1 m	13.0 (3.5)	8.0 (1.3)	11.3 (1.7)	24.4 (6.3)
		2 m	13.0 (3.9)	6.0 (0.6)	10.1 (1.4)	15.9 (4.0)
		3 m	10.8 (3.0)	5.6 (0.7)	8.1 (1.4)	12.1 (2.9)
		4 m	9.3 (2.4)	6.1 (0.7)	7.8 (1.2)	10.0 (2.3)
	Occlusion off	4 m 15 s	57.6 (10.9)	58.7 (13.1)	106.4 (22.4)	62.2 (9.2)
		4 m 30 s	77.6 (13.5)	80.5 (19.3)	139.8 (25.4)	86.7 (12.2)
		4 m 45 s	85.1 (13.9)	90.4 (21.4)	153.4 (26.1)	93.0 (12.4)
		5 m	85.3 (13.8)	92.7 (21.7)	157.8 (27.7)	96.4 (11.4)
		5 m 15 s	83.5 (13.5)	92.9 (22.1)	162.9 (28.8)	97.4 (11.2)
		5 m 30 s	82.2 (13.5)	89.0 (20.5)	162.0 (29.4)	98.5 (10.9)
		5 m 45 s	81.9 (13.5)	85.1 (20.1)	161.4 (29.0)	85.0 (9.9)
		6 m	78.2 (12.4)	82.9 (20.2)	157.4 (28.5)	92.6 (10.1)
		6 m 15 s	75.2 (12.5)	80.9 (19.4)	152.2 (28.3)	92.4 (10.4)
		6 m 30 s	75.0 (12.4)	77.7 (18.2)	151.8 (29.1)	93.7 (10.7)
		6 m 45 s	72.2 (12.0)	77.7 (18.8)	152.0 (29.4)	91.6 (10.2)
		7 m	73.6 (12.3)	75.3 (18.0)	150.1 (29.8)	91.9 (9.6)

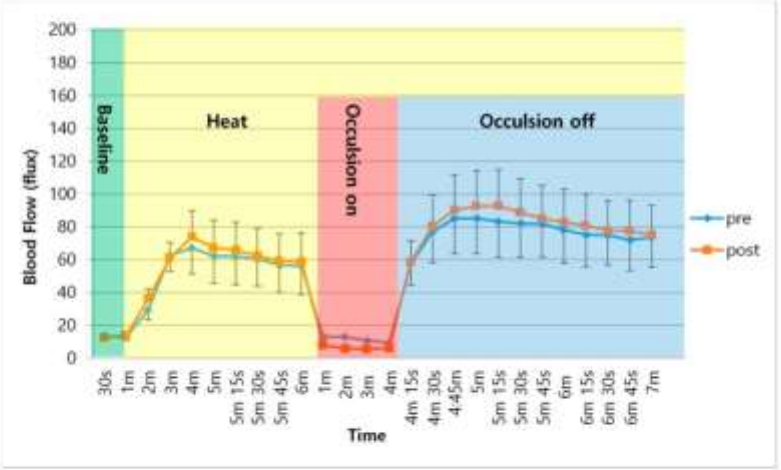

Figure 2. Mean and SD of Skin blood flow over time between pre- and post-intervention in diabetic group.

As shown in Figure 1, following the application of heat to the skin, skin blood flow increased for the first 3 min of exposure and then peaked, which was followed by a small reduction in skin blood flow over the subsequent 5 min in the healthy subjects. This occurred both before and after the TC training. However, the peak skin blood flow response and sustained skin blood flow after exposure to heat was significantly lower after the TC exercise in these subjects than before the TC exercise training ($p < 0.05$). After occlusion, there was even a greater reduction in skin blood flow after TC exercise. This difference was also significant ($p < 0.05$). The skin blood flow response in the diabetes group followed a similar course, as shown in Figure 2. The average resting skin blood flow, blood flow after occlusion, and increased skin temperature were significantly lower in the diabetes group than in the healthy subjects ($p < 0.05$). Furthermore, there were no significant changes in mean skin blood flow after the TC exercise when heat was on, with occlusion on, or with occlusion off ($p > 0.05$).

The mean SBP and DBP improved significantly in both groups. The average SBP decreased significantly after the TC exercise in both diabetic patients and in healthy subjects ($p < 0.01$). However, there was no significant difference between the two groups ($p < 0.05$, Table 4). The average DBP significantly decreased after the TC exercise ($p < 0.001$, $p = 0.03$, respectively) and this difference was not significantly different between the two study groups ($p = 0.37$, Table 4).

Table 4. Mean (SD) of systolic and diastolic blood pressure at pre- and post-intervention over the time in diabetic ($n = 12$) and healthy subjects ($n = 17$).

Tool	Group		Mean (SD)	Pre-Post *p*-Value [a]	Between Group *p*-Value [b]
Systolic Blood Pressure (SBP)	Diabetic	Pre	141.4 (3.7)	0.002	0.16
		Post	128.8 (4.2)		
	Healthy Subjects	Pre	132.9 (4.9)	0.009	
		Post	120.8 (4.2)		
Diastolic Blood Pressure (DBP)	Diabetic	Pre	80.8 (2.2)	<0.001	0.37
		Post	71.6 (2.3)		
	Healthy Subjects	Pre	75.8 (2.3)	0.03	
		Post	71.0 (2.3)		

[a] *p*-value from paired *t*-test. [b] *p*-value independent *t*-test.

4. Discussion

In the present investigation, we assessed the effects of TC training, combined with MI, on improving blood pressure and peripheral cutaneous microcirculatory function in people with diabetes and in an age-matched control group. We found a reduction in systolic and diastolic blood pressure, and an improvement in balance as shown by an increase in motor control in both groups after TC and MI exercises. The ABC, SLS and FRT all showed significant improvements. However, skin blood flow, in response to occlusion and heat, was lower after the TC exercises in both groups. Thus there was a sensory and motor benefit to TC but the skin blood flow at rest and in response to the two stressors used here (occlusion and heat) was not improved after the TC exercise. It may be that motor control and sensory function comprise components that are independent of skin blood flow and others that are altered by blood flow. This concept is confirmed by the data reported in Table 3, which indicate motor function is increased in individuals with diabetes, although not to the same extent as in the healthy subjects. Perhaps if endothelial function had improved, the two groups would have been more similar at the end of the study, but as both groups differed, there were, therefore, other factors still able to reduce motor function in individuals with diabetes. The fact that both groups improved motor performance shows the value of Tai Chi for improving motor skills. The fact that people with diabetes showed the same improvement as healthy subjects shows that the motor control loss with ageing was more significant than any changes associated with diabetes.

Other studies have examined the effect of TC on balance. For example, a recent review showed that TC can prevent falls and improve balance in older people and in people with Parkinson's disease [30]. However, no definitive conclusions could be drawn from this systematic review on the effect of Tai Chi on stroke, osteoarthritis and heart failure. In another Cochrane review of the effects of various types of exercise on the fear of falling in older adults, it was concluded that there was no evidence that the fear of falling was reduced after the exercise was over [31]. TC has also been shown to reduce falls in people with dementia [32,33]. A common problem in all of these studies is that the experience of the instructor and length of time TC is used and the number of times per week is variable and, therefore, it is hard to compare some of these studies to each other [34]. This was driven home in a recent systematic review of 25 studies on TC in diabetes. Here, no conclusion on the effect of TC on balance in people with diabetes could be drawn due to differences in techniques, instructors and the length of time people participated [35]. However, other reviews do agree with the present investigation in that they also found a reduction in blood pressure with TC and HbA1C [36]. In the present investigation, mental imagery during exercise was combined with TC. This has been shown to increase the H-reflex in the soleus and increase conduction velocity compared to TC alone [37]. MI seems to add a benefit to Tai Chi but as so many reviews have pointed out, comparison of studies needs more consistence in the type and duration of the exercise.

Since motor control was shown to improve in the present study equally well in age-matched healthy subjects and people with diabetes, physical therapists are encouraged to recommend TC plus MI exercise for diabetics and geriatric patients. People with diabetes, who inherently have poor balance and motor control were able to tolerate TC and complete the program. The results of this study suggest that combining a MI strategy while doing TC exercise is a potential approach to promote and accelerate the "re-learning" process, which could improve balance and gait and more importantly, prevent falls. The reduction in blood pressure seen here with TC indicates the cardiovascular benefits that may act to reduce the chance of heart disease.

However, this study has several limitations. First, 27.5% of the subjects (11 subjects) dropped out of the study. Even though the basic characteristics and baseline measurements of drop-out subjects were not significantly different from subjects who completed the study, stronger motivation should have been encouraged. Also, the small sample size due to the big drop-outs could lower the statistical power. Another important limitation of this study is the control over other daily life activities. It is unknown to what degree the TC effects achieved were derived only from TC training. Other daily physical activities or exercises may have affected the results. Another factor limiting the generalization of the results is the protective effect of anti-oxidants on endothelial function observed in different races [38,39]. Further study is needed to control for these factors to confirm an actual effect of TC with MI.

5. Conclusions

In conclusion, combining TC intervention with MI theory showed an improvement in functional outcomes and blood pressure, which showed cardiovascular benefits. However, cutaneous microcirculatory function did not improve.

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References

1. Petrofsky, J.S.; Alshammari, F.; Bains, G.S.; Khowailed, I.A.; Lee, H.; Kuderu, Y.N.; Lodha, R.D.; Rodrigues, S.; Nguyen, D.; Potnis, P.A.; et al. What is more damaging to vascular endothelial function: Diabetes, age, high BMI, or all of the above? *Med. Sci. Monit.* **2013**, *19*, 257–263. [CrossRef] [PubMed]
2. Petrofsky, J.S.; Lawson, D.; Suh, H.J.; Rossi, C.; Zapata, K.; Broadwell, E.; Littleton, L. The influence of local versus global heat on the healing of chronic wounds in patients with diabetes. *Diabetes Technol. Ther.* **2007**, *9*, 535–544. [CrossRef] [PubMed]
3. Accurso, V.; Shamsuzzaman, A.S.; Somers, V.K. Rhythms, rhymes, and reasons—spectral oscillations in neural cardiovascular control. *Auton. Neurosci.* **2001**, *90*, 41–46. [CrossRef]
4. Petrofsky, J.; Lee, S.; Cuneo, M. Effects of aging and type 2 diabetes on resting and post occlusive hyperemia of the forearm; the impact of rosiglitazone. *BMC Endocr. Disord.* **2005**, *5*, 4. [CrossRef]
5. Sagliocco, L.; Sartucci, F.; Giampietro, O.; Murri, L. Amplitude loss of electrically and magnetically evoked sympathetic skin responses in early stages of type 1 (insulin-dependent) diabetes mellitus without signs of dysautonomia. *Clin. Auton. Res.* **1999**, *9*, 5–10. [CrossRef]
6. Fealey, R.D.; Low, P.A.; Thomas, J.E. Thermoregulatory sweating abnormalities in diabetes mellitus. *Mayo Clin. Proc.* **1989**, *64*, 617–628. [CrossRef]
7. Petrofsky, J.S.; Besonis, C.; Rivera, D.; Schwab, E.; Lee, S. Heat tolerance in patients with type I and type II diabetes. *J. Appl. Res. Clin. Exp. ther.* **2003**, *3*, 328–334.
8. Anggard, E. Nitric oxide: Mediator, murderer, and medicine. *Lancet* **1994**, *343*, 1199–1206. [CrossRef]
9. Johnstone, M.T.; Creager, S.J.; Scales, K.M.; Cusco, J.A.; Lee, B.K.; Creager, M.A. Impaired endothelium-dependent vasodilation in patients with insulin-dependent diabetes mellitus. *Circulation* **1993**, *88*, 2510–2516. [CrossRef]
10. Taddei, S.; Virdis, A.; Mattei, P.; Ghiadoni, L.; Fasolo, C.B.; Sudano, I.; Salvetti, A. Hypertension causes premature aging of endothelial function in humans. *Hypertension* **1997**, *29*, 736–743. [CrossRef]
11. Taddei, S.; Virdis, A.; Mattei, P.; Ghiadoni, L.; Gennari, A.; Fasolo, C.B.; Sudano, I.; Salvetti, A. Aging and endothelial function in normotensive subjects and patients with essential hypertension. *Circulation* **1995**, *91*, 1981–1987. [CrossRef] [PubMed]
12. Kvernmo, H.D.; Stefanovska, A.; Kirkeboen, K.A.; Osterud, B.; Kvernebo, K. Enhanced endothelium-dependent vasodilatation in human skin vasculature induced by physical conditioning. *Eur. J. Appl. Physiol. Occup. Physiol.* **1998**, *79*, 30–36. [CrossRef] [PubMed]
13. Delp, M.D. Effects of exercise training on endothelium-dependent peripheral vascular responsiveness. *Med. Sci. Sports Exerc.* **1995**, *27*, 1152–1157. [CrossRef] [PubMed]
14. Dickstein, R.; Deutsch, J.E. Motor imagery in physical therapist practice. *Phys. Ther.* **2007**, *87*, 942–953. [CrossRef]
15. Malouin, F.; Richards, C.L. Mental practice for relearning locomotor skills. *Phys. Ther.* **2010**, *90*, 240–251. [CrossRef]
16. Wang, J.S.; Lan, C.; Wong, M.K. Tai Chi Chuan training to enhance microcirculatory function in healthy elderly men. *Arch. Phys. Med. Rehabil.* **2001**, *82*, 1176–1180. [CrossRef]
17. Wang, J.S.; Lan, C.; Chen, S.Y.; Wong, M.K. Tai Chi Chuan training is associated with enhanced endothelium-dependent dilation in skin vasculature of healthy older men. *J. Am. Geriatr. Soc.* **2002**, *50*, 1024–1030. [CrossRef]
18. Lan, C.; Chen, S.Y.; Wong, M.K.; Lai, J.S. Tai Chi training for patients with coronary heart disease. *Med. Sport Sci.* **2008**, *52*, 182–194. [CrossRef]
19. Tsai, J.C.; Wang, W.H.; Chan, P.; Lin, L.J.; Wang, C.H.; Tomlinson, B.; Hsieh, M.H.; Yang, H.Y.; Liu, J.C. The beneficial effects of Tai Chi Chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial. *J. Altern/ Complement. Med.* **2003**, *9*, 747–754. [CrossRef]
20. Pan, X.; Zhang, Y.; Tao, S. Effects of Tai Chi exercise on blood pressure and plasma levels of nitric oxide, carbon monoxide and hydrogen sulfide in real-world patients with essential hypertension. *Clin. Exp. Hypertens.* **2015**, *37*, 8–14. [CrossRef]
21. Sun, J.; Buys, N. Community-based mind-body meditative tai chi program and its effects on improvement of blood pressure, weight, renal function, serum lipoprotein, and quality of life in Chinese adults with hypertension. *Am. J. Cardiol.* **2015**, *116*, 1076–1081. [CrossRef]

22. Powell, L.E.; Myers, A.M. The Activities-specific Balance Confidence (ABC) Scale. *J. Gerontol. A Biol. Sci. Med. Sci.* **1995**, *50A*, M28–M34. [CrossRef] [PubMed]
23. Talley, K.M.; Wyman, J.F.; Gross, C.R. Psychometric properties of the activities-specific balance confidence scale and the survey of activities and fear of falling in older women. *J. Am. Geriatr. Soc.* **2008**, *56*, 328–333. [CrossRef] [PubMed]
24. Duncan, P.W.; Weiner, D.K.; Chandler, J.; Studenski, S. Functional reach: A new clinical measure of balance. *J. Gerontol.* **1990**, *45*, M192–M197. [CrossRef] [PubMed]
25. Vellas, B.J.; Wayne, S.J.; Romero, L.; Baumgartner, R.N.; Rubenstein, L.Z.; Garry, P.J. One-leg balance is an important predictor of injurious falls in older persons. *J. Am. Geriatr. Soc.* **1997**, *45*, 735–738. [CrossRef] [PubMed]
26. Jonsson, E.; Seiger, A.; Hirschfeld, H. One-leg stance in healthy young and elderly adults: A measure of postural steadiness? *Clin. Biomech.* **2004**, *19*, 688–694. [CrossRef] [PubMed]
27. Menant, J.C.; Steele, J.R.; Menz, H.B.; Munro, B.J.; Lord, S.R. Optimizing footwear for older people at risk of falls. *J. Rehabil. Res. Dev.* **2008**, *45*, 1167–1181. [CrossRef] [PubMed]
28. Tsai, Y.J.; Lin, S.I. Older adults adopted more cautious gait patterns when walking in socks than barefoot. *Gait Posture* **2013**, *37*, 88–92. [CrossRef]
29. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*; Academic Press: Cambridge, MA, USA, 2013.
30. Zhong, D.; Xiao, Q.; Xiao, X.; Li, Y.; Ye, J.; Xia, L.; Zhang, C.; Li, J.; Zheng, H.; Jin, R. Tai Chi for improving balance and reducing falls: An overview of 14 systematic reviews. *Ann. Phys. Rehabil. Med.* 2020. [CrossRef]
31. Kendrick, D.; Kumar, A.; Carpenter, H.; Zijlstra, G.A.; Skelton, D.A.; Cook, J.R.; Stevens, Z.; Belcher, C.M.; Haworth, D.; Gawler, S.J.; et al. Exercise for reducing fear of falling in older people living in the community. *Cochrane Database Syst. Rev.* 2014. [CrossRef]
32. Nyman, S.R.; Ingram, W.; Sanders, J.; Thomas, P.W.; Thomas, S.; Vassallo, M.; Raftery, J.; Bibi, I.; Barrado-Martin, Y. Randomised controlled trial of the effect of Tai Chi on postural balance of people with dementia. *Clin. Interv. Aging* **2019**, *14*, 2017–2029. [CrossRef]
33. Barrado-Martin, Y.; Heward, M.; Polman, R.; Nyman, S.R. Acceptability of a dyadic Tai Chi intervention for older people living with dementia and their informal carers. *J. Aging Phys. Act.* **2019**, *27*, 166–183. [CrossRef]
34. Mercuris, K.; Lowry, K.; Espey, S. Does instructor experience impact balance and health-related quality of life in healthy older adult participants following a Tai Chi for arthritis program? *J. Commun. Health Nurs.* **2020**, *37*, 26–34. [CrossRef]
35. Zhou, Z.; Zhou, R.; Li, K.; Zhu, Y.; Zhang, Z.; Luo, Y.; Luan, R. Effects of tai chi on physiology, balance and quality of life in patients with type 2 diabetes: A systematic review and meta-analysis. *J. Rehabil. Med. Off. J. UEMS Eur. Board Phys. Rehabil. Med.* **2019**, *51*, 405–417. [CrossRef]
36. Chao, M.; Wang, C.; Dong, X.; Ding, M. The effects of tai chi on type 2 diabetes mellitus: A meta-analysis. *Journal Diabetes Res.* **2018**, *2018*, 7350567. [CrossRef]
37. Alsubiheen, A.; Petrofsky, J.; Daher, N.; Lohman, E.; Balbas, E.; Lee, H. Tai Chi with mental imagery theory improves soleus H-reflex and nerve conduction velocity in patients with type 2 diabetes. *Complement. Ther Med.* **2017**, *31*, 59–64. [CrossRef]
38. Yim, J.; Petrofsky, J.; Berk, L.; Daher, N.; Lohman, E.; Moss, A.; Cavalcanti, P. Protective effect of anti-oxidants on endothelial function in young Korean-Asians compared to Caucasians. *Med. Sci. Monitor. Int. Med. J. Exp. Clin. Res.* **2012**, *18*, CR467–CR479. [CrossRef]
39. Yim, J.; Petrofsky, J.; Berk, L.; Daher, N.; Lohman, E. Differences in endothelial function between Korean-Asians and Caucasians. *Med. Sci. Monitor. Int. Med. J. Exp. Clin. Res.* **2012**, *18*, CR337–CR343. [CrossRef]