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Dynamic Resistance Training as Stand-Alone Antihypertensive Lifestyle Therapy: A Meta-Analysis

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***Background*—**Aerobic exercise (AE) is recommended as first-line antihypertensive lifestyle therapy based on strong evidence showing that it lowers blood pressure (BP) 5 to 7 mm Hg among adults with hypertension. Because of weaker evidence showing that dynamic resistance training (RT) reduces BP 2 to 3 mm Hg among adults with hypertension, it is recommended as adjuvant lifestyle therapy to AE training. Yet, existing evidence suggests that dynamic RT can lower BP as much or more than AE.

***Methods and Results*—**We meta-analyzed 64 controlled studies (71 interventions) to determine the efficacy of dynamic RT as stand-alone antihypertensive therapy. Participants (N=2344) were white (57%), middle-aged (47.2±19.0 years), and overweight (26.8±3.4 kg/m^2) adults with prehypertension (126.7±10.3/76.8±8.7 mm Hg); 15% were on antihypertensive medication. Overall, moderate-intensity dynamic RT was performed 2.8±0.6 days/week for 14.4±7.9 weeks and elicited small-to-moderate reductions in systolic BP (SBP; $d_+=-0.31$; 95% CIs, −0.43, −0.19; −3.0 mm Hg) and diastolic BP (DBP; $d_+=-0.30$; 95% CIs, −0.38, −0.18; −2.1 mm Hg) compared to controls ($Ps<0.001$). Greater BP reductions occurred among samples with higher resting SBP/DBP: ≈6/5 mm Hg for hypertension, ≈3/3 mm Hg for prehypertension, and ≈0/1 mm Hg for normal BP ($Ps<0.023$). Furthermore, nonwhite samples with hypertension experienced BP reductions that were approximately twice the magnitude of those previously reported following AE training (−14.3 mm Hg [95% CIs, −19.0, −9.4]/−10.3 mm Hg [95% CIs, −14.5, −6.2]).

***Conclusions*—**Our results indicate that for nonwhite adult samples with hypertension, dynamic RT may elicit BP reductions that are comparable to or greater than those reportedly achieved with AE training. Dynamic RT should be further investigated as a viable stand-alone therapeutic exercise option for adult populations with high BP. **(*J Am Heart Assoc*. 2016;5:e003231 doi: 10.1161/JAHA.116.003231)**

Key Words: exercise training • high blood pressure • hypertension • lifestyle • meta-analysis • systematic review

Hypertension is the most prevalent, modifiable, and costly risk factor for cardiovascular disease (CVD).[1] Nearly ≈33% (80 million) of US adults currently have hypertension,[1] and by 2030, this number is projected to reach 41.1%.[1,2] Lifestyle-related factors have been identified as the only modifiable determinants of hypertension.[2] As a result, numerous randomized controlled trials (RCTs) and over 33 meta-analyses[3,4] have investigated the antihypertensive effects of exercise. Collectively, these meta-analyses concluded that aerobic exercise (AE) lowers blood pressure (BP) 5 to 7 mm Hg, whereas dynamic resistance training (RT) lowers BP 2 to 3 mm Hg among adults with hypertension.[3–6] Accordingly, 30 to 60 min/day of moderate-intensity AE is recommended on most days of the week supplemented by moderate-intensity dynamic RT on ≥2 days/week to prevent, treat, and control hypertension.[4,6] Yet, a more-critical review of this literature revealed considerable variability in the magnitude of the BP reductions following both AE (ie,

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Accompanying Data S1, S2, Tables S1 through S7, and Figures S1 through S3 are available at http://jaha.ahajournals.org/content/5/10/e003231/DC1/embed/inline-supplementary-material-1.pdf

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1–9 mm Hg) and dynamic RT (ie, 0–6 mm Hg), for reasons that are not clear.[4]

In contrast to the strong evidence supporting the BP-lowering effects of AE, there is much weaker and limited evidence supporting the efficacy of dynamic RT as stand-alone antihypertensive therapy.[4,6] In addition to several reviews,[3–6] 6 meta-analyses to date have exclusively examined the BP-lowering effects of dynamic RT,[7–12] which included mostly healthy adults with normal BP and prehypertension. Importantly, none of these meta-analyses completely satisfied contemporary methodological quality standards[3,13–15] nor were they able to identify important sample or dynamic RT characteristics that modulated the BP response to dynamic RT. Meta-analyses routinely cited poor reporting,[7,9] low methodological study quality,[10,11] and the small number of RT studies[7,8,10,11] as limitations of their meta-analyses, and hence, lack of significant findings. Yet, meta-analyses rarely examined how methodological study quality influenced their study results,[8,10,11] applied stringent inclusionary criteria,[9,10,12] and used subgroup analysis to investigate potential moderators, an approach that is less precise than other conventional techniques, especially among small samples.[16–19] Because of these notable limitations, previous meta-analyses likely underestimated the antihypertensive effects of dynamic RT, calling into question the generalizability of their findings to adult populations with high BP.[3,4]

Several primary level studies have shown that systolic BP (SBP)/diastolic BP (DBP) reductions following dynamic RT are comparable to that of AE among adults with hypertension,[20] reporting SBP/DBP reductions of ≈7 to 16/6 to 12 mm Hg and ≈10 to 14/1 to 4 mm Hg among adults with untreated[21–23] and controlled[24–26] hypertension, respectively. Although limited, controlled studies directly comparing the effectiveness of AE and dynamic RT as antihypertensive therapy found that dynamic RT reduced BP to similar levels as AE[20] among adults with untreated (≈7–14/6–8 mm Hg)[21,23] and controlled (≈10/3 mm Hg)[24,27] hypertension.

Therefore, the purposes of our meta-analysis were to provide more precise estimates regarding the efficacy of dynamic RT as stand-alone antihypertensive therapy, and identify potential moderators of this response to provide insight into the optimal dose of dynamic RT to lower BP among adults with high BP.

Methods

This study fully satisfies the criteria implied by the PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses),[14,15] AMSTAR Methodological Quality Scale (Assessment of Multiple SysTemAtic Reviews),[13,28] and AMSTAR$_{\text{ExBP}}$, an augmented version of the AMSTAR designed specifically to assess meta-analyses examining the BP response to exercise.[3] Institutional review board approval was not required for the current research because it is a meta-analysis of controlled dynamic RT interventions, which is not considered as research involving human subjects.

Inclusion Criteria

Controlled studies were eligible for inclusion if they satisfied 4 a priori criteria: (1) involved adult participants (≥19 years);[29,30] (2) involved a non-exercise/non-diet control or comparison group; (3) reported BP pre- and post-intervention for dynamic RT and control groups; and (4) reported the Frequency, Intensity, and Time (or FIT) of the dynamic RT intervention. Studies involving weight loss drugs, diet therapy, or diet modifications in addition to dynamic RT were excluded. Approximately half of US adults (49.8%)[31] have at least 1 lifestyle-related chronic health condition (eg, diabetes mellitus, CVD risk factors, etc, that require ongoing medical attention and/or limits activities of daily living[32,33]), and of these, another half (25.5%) have 2 or more of these conditions.[31] Given that hypertension usually occurs in conjunction with other metabolically linked CVD risk factors (ie, <20% occurs in isolation),[34] and more than half of adults with hypertension have a cluster of 2 or more CVD risk factors,[34] we only excluded studies that involved populations with disease(s) or health conditions unrelated to CVD (eg, arthritis, cancer, HIV/AIDS).

Search Strategy

In consultation with a medical librarian (J.L.), exhaustive Boolean searches were run in 5 electronic databases from inception until January 31, 2014 to identify all relevant studies. Potentially qualifying reports were retrieved from the following electronic databases: Cumulative Index to Nursing and Allied Health Literature, PubMed (including Medline), Scopus (including EMBASE), SportDiscus, and Web of Science (online supplemental material, Data S1, provides the full search strategy for each electronic database). Four investigators (H.V.M., T.U.G., K.C.F., and L.M.L.) screened the sample for inclusion with duplication of effort. Reference lists of included studies, relevant reviews, and meta-analyses were manually searched for additional reports.

Data Extraction and Coded Variables

Coded variables were extracted using a standardized coding form and coder manual previously developed by a team of experts (L.S.P., B.T.J., T.B.H.M) and pilot tested. Two trained coders (H.V.M., K.C.F.) independently extracted and entered study information with high reliability across all dimensions (mean Cohen κ=0.86 for categorical variables;[35] mean Pearson r=0.94 for continuous variables); all disagreements were resolved by discussion. Coded variables included methodological study quality and characteristics of the study, sample, and dynamic RT intervention. Only 14% of the studies[21,24,36–42] disclosed the race/ethnicity of their study participants. When unreported, race/ethnicity was estimated using study location;[43–45] samples were considered "white" for North America, Europe, and Australia; "Asian" for Asia and India; "Hispanic/Latino" for South and Central America; and "Black" for Africa. Approximately one-third of studies failed to disclose information regarding BP medication use among their study participants. Similar estimates were observed among studies that did not report BP medication use (k=22) and those that reported no BP medication use among their sample (k=35; $P>0.05$); therefore, these studies were combined (k=57) for subsequent moderator analyses. Chronic diseases and health conditions related to CVD were categorized based on the total number reported in the sample.[31,46] Studies that reported ≥2 chronic diseases/health conditions among their sample were categorized as having "multiple chronic conditions."[32,33]

Methodological quality of the studies in our sample was assessed using a modified version of the Downs and Black Checklist[47,48] (see Data S2 for the augmented checklist). This instrument[49] is well validated in the health promotion literature and is reliable for assessing both RCTs and non-RCTs.[50] The Downs and Black checklist addresses 5 subscales of quality (ie, reporting, external validity, bias, confounding, and power) and is considered one of the most comprehensive instruments available for assessing methodological study quality.[50] The *overall* methodological quality was gauged as percentage of items satisfied out of a possible 29-point total and was quantified as: low (≤14 points, <50%), moderate (>14–23 points, 50–79%), or high (≥24 points, ≥80%).[47,48] In addition to quantifying the quality of the dynamic RT literature, we examined how *overall* methodological quality, quality subscales, and individual dimensions of quality influenced the BP response to dynamic RT *independently* and *interactively*[51] with other moderators.

Study Outcomes and Effect-Size Calculation

Standardized mean difference effect size (d) was used to quantify the effectiveness of dynamic RT as stand-alone antihypertensive therapy, defined as the mean difference in resting SBP/DBP between dynamic RT and control groups post- versus pre-intervention divided by the pooled SD, correcting for small sample size bias and baseline differences.[52,53] We disaggregated comparisons for studies with >1 dynamic RT interventions (eg, high vs low intensity RT);[42,54–59] *d*s were calculated for each comparison (k) and analyzed as separate studies.[60] Negative *d* values indicated that dynamic RT reduced BP more than the non-exercise control group, and the magnitude of *d* values was interpreted as −0.20, −0.50, and −0.80 for small, medium and large BP reductions.[61] Last, we provide the *unstandardized* mean effect size (ie, BP difference in mm Hg between RT and control groups at post- versus pre-intervention)[60,62] as a supplement to *d* in order to enhance the clinical utility of our findings.[63]

Inconsistencies in *d*s were estimated with the Q statistic[64] and transformed into the I^2 statistic and its 95% CIs.[65,66] I^2 values range from 0% (homogeneity) to 100% (greater heterogeneity); a CI that does not include 0% indicates that the hypothesis of homogeneity is rejected, and an inference of heterogeneity is merited.[65,66]

Moderator Analyses

Given the considerable variability in the magnitude of the BP reductions observed following exercise training (ie, 0–9 mm Hg),[4] we examined theoretically driven, a priori study-level moderators (ie, *effect modifiers*) related to characteristics of the study (eg, methodological study quality, BP-focused outcome), sample (eg, baseline BP, race/ethnicity), and dynamic RT intervention (eg, the FIT, number of RT exercises) to determine what combinations elicited the greatest BP reductions. Weighted regression models (viz, meta-regressions) with maximum-likelihood estimation of the random-effects weights, the inverse of the variance for each *d*, were used to explain the variability in *d*s for SBP and DBP. Continuous moderators were mean centered and categorical variables were contrast coded before generating interaction terms or performing multiple moderator analyses.[51,67]

Multiple moderator meta-regression models

Because meta-analysis is correlational in nature, we did not rely solely on individual bivariate metaregressions to "pre-screen" which a priori, theoretically driven, study-level moderators would be examined in multiple moderator models.[18,51,68] In addition to identifying significant or trending ($P\leq0.10$) moderators in bivariate meta-regression, we also examined the model coefficient and R^2 value (ie, proportion of variance explained by the covariate) for individual moderators to gauge its influence on the BP response to RT.[18]

Moderator patterns should emerge more clearly among higher-quality studies,[69–71] where threats to validity and other biases are minimized and potentially confounding variables are accounted for (ie, "suppression effect"[72]).[18,51,68] Because we did not exclude potentially relevant studies based on the experimental design (ie, we included both RCTs and non-RCTs), level of evidence (ie, methodological quality), or "risk of bias," we used the "meta-regression adjustment approach"[73] to empirically control or adjust for possible methodological differences across RT studies.[18,51,68,74,75] Therefore, we included *overall* methodological study quality or individual quality dimensions (eg, BP-focused study outcome) in our multiple moderator models when feasible.

The moving constant technique

Although it is commonly ignored in practice,[67] the constant (or intercept) in a meta-regression model can be extremely valuable in demonstrating how *ds* vary at different points along the study-level moderator variable (or variables; eg, Ferrer et al[70] and Brown et al[69,71]), across clinic thresholds, or other practical criteria (eg, Kirsch et al[76]). We used the moving constant technique[67] to estimate the magnitude of weighted mean effect sizes (d_+) and their CIs at different levels of interest for individual study-level moderators, including extreme values and other observations, within that range. These estimates, or predicted d_+ values ($\widehat{d}_+$), and their 95% CIs statistically control for the presence of each moderator in the model, held constant at their mean levels, except for the moderator and level of interest.

Additive model

For both SBP and DBP, an additive model was generated from the final multiple moderator model that represented the greatest *potential* antihypertensive benefit that could be achieved with dynamic RT. In this approach, individual moderators and interaction terms are evaluated simultaneously at the level (ie, $\widehat{d}_+$ and 95% CIs) that confers the largest BP reductions, which in turn, identifies the combination of study-level moderators, including sample and dynamic RT characteristics, that elicits *optimal* antihypertensive benefit.

In order to facilitate clinical interpretations, we transformed our results arithmetically to provide the equivalent BP change in mm Hg. For each moderator dimension and level of interest, we back-converted the standardized estimate (ie, $\widehat{d}_+$) into mm Hg of BP change by multiplying the predicted *d* values by the SD corresponding to the BP level of interest.[63] Specific transformation details appear in the table footnotes.

Publication Bias

We visually examined funnel plots for any asymmetries in the effect-size distribution to identify potential publication or other reporting biases.[77] We also evaluated the potential for publication bias using Begg[78] and Egger[79] methods; neither test suggested publication bias (*Ps*>0.19; see Figures S1 and S2).

Sensitivity Analyses

To determine whether multiple treatment studies (ie, non-independent effect sizes that result from different RT interventions being compared to a single control group)[80] influenced our weighted mean estimates and multiple moderator meta-regressions, we performed alternative analyses in R[81] using the metafor package (viz, *rma.mv* function).[80,82] Multivariate meta-analytic models, following random-effects assumptions with maximum-likelihood estimation that accounted for these issues, yielded the same pattern of results (see Tables S1 and S2 for the multivariate mean estimates and multiple moderator models). For simplicity of interpretation, we only report the maximum-likelihood estimation analyses for SBP and DBP below.

Statistical Computing

Continuous variables are summarized as mean±SD, unless otherwise stated, and categorical variables are presented as absolute values and percentages. Differences in baseline characteristics between the dynamic RT and control groups were examined using *t*-tests, one-way ANOVA, and Fisher's exact test. Analyses used Stata software (version 13.1; StataCorp LP, College Station, TX)[83] with macros for meta-analysis,[60,84] incorporating random-effects assumptions. Two-sided statistical significance was $P<0.05$.

Results

We identified 64 controlled studies that satisfied inclusionary criteria.* Seven studies involved >1 dynamic RT groups comparing lower- versus higher-intensity RT,[42,57–59] strength versus power RT,[55] elastic band versus aquatic RT,[54] and eccentric versus concentric RT,[56] yielding 71 *total* interventions. Figure shows the systematic search for potential reports and selection process of included dynamic RT studies.

Study Characteristics

Table S3 provides a general description of each study, sample, and intervention characteristics for the dynamic RT and control groups. Included RT studies were published between 1987 and 2013, the majority were RCTs (82%), and approximately half examined BP as a primary study outcome (48%). Most interventions involved a non-exercise/wait-listed control group (86%); 9 studies involved a "placebo" control/comparison group† (Table S3).

Included studies achieved "moderate" methodological study quality (≈63%),[47,48] despite widely varying scores (41–85%; see Table S4). Studies were most likely to satisfy reporting (78.6%) and internal validity (bias=70.2% and confounding=51.5%) quality subscales, but least likely to satisfy external validity (46.5%) and power (9.2%). None of the subscales emerged as significant moderators in analyses; only

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*21, 23–27, 36–42, 54–59, 85–129.

†27, 38, 85, 94, 98, 101, 110, 112, 126.

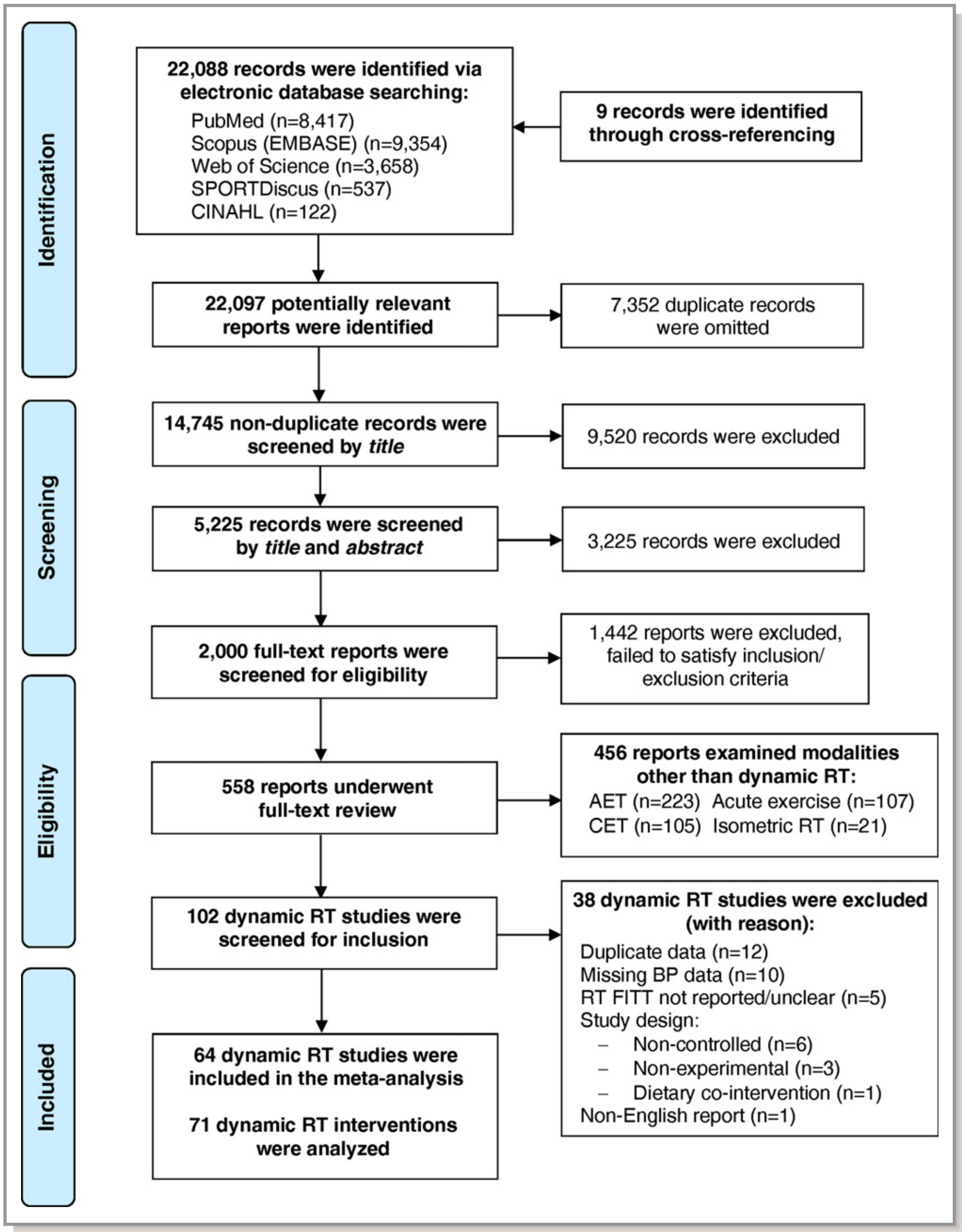

Figure. Flow chart detailing the systematic search of potential reports (n) and selection process of included dynamic resistance training studies. AET indicates aerobic exercise training; BP, blood pressure; CINAHL, cumulative index to nursing and allied health literature; CET, concurrent exercise training; FITT, Frequency, Intensity, Time and Type; RT, resistance training.

7 studies satisfied ≥80% of quality items (≈83.3%; see Table S5 for the overall and itemized summary of methodological study quality for each intervention).

Sample Characteristics

Table 1 summarizes baseline sample characteristics for the RT and control groups. The dynamic RT (total N across samples=1305) and control (N=1039) samples were sedentary,[130] middle-aged (47.4±19.0 years), overweight (26.7±3.5 kg/m^2) adults with prehypertension (SBP/DBP: 126.4±9.4/76.6±8.4 mm Hg).[131] Approximately 15% of the total sample was on antihypertensive medication (N=349), but one-third of studies did not disclose this information (≈68% did). The majority of RT studies (≈60%) involved adults without CVD-related chronic diseases or health conditions other than their high BP (N=1286). A small subset of RT studies included participants with known CVD-related chronic diseases (3 studies; N=64),[55,86,103] or CVD risk factors other

Table 1. Baseline Sample Characteristics for the Dynamic RT (k=71) and Control (k=63) Intervention Groups

Characteristic	k	Dynamic RT (n=1305)	k	Control (n=1039)
Women, n (%)	69	622 (47.7)	61	477 (45.9)
Age, y	68	47.2±19.0	61	47.2±19.1
Race/ethnicity, n (%)	71		63	
White	40	775 (59.4)	36	554 (53.3)
Asian	17	263 (20.2)	14	227 (21.8)
Hispanic/Latino/Caribbean	13	254 (19.5)	12	243 (23.4)
Black/African American	1	13 (1.0)	1	15 (1.4)
Sedentary, n (%)*	53	926 (71.0)	47	764 (73.5)
BP medication, n (% using)	49	177 (13.6)	42	172 (16.5)
BP classification, n (%)[†]				
Normal	16	242 (18.5)	12	164 (15.8)
Prehypertension	41	688 (52.7)	41	587 (56.5)
Hypertension	14	375 (28.7)	10	292 (28.1)
Health status, n (%)	65		54	
No CVD-related chronic conditions[‡]	38	611 (46.8)	33	446 (42.9)
CVD-related chronic conditions[§]	27	499 (38.2)	21	380 (36.6)
1 chronic disease/health condition[‖]	16	280 (21.5)	11	158 (15.2)
2 to 3 chronic diseases/health conditions[¶]	7	69 (5.3)	6	68 (6.5)
≥4 chronic diseases/health conditions[¶]	4	150 (11.5)	4	154 (14.8)
Chronic conditions reported per sample		1.9±1.3		2.0±1.3
Body composition				
Body weight, kg	61	75.0±11.7	59	74.1±12.0
BMI, kg/m^2	60	26.8±3.4	58	26.6±3.7
Waist circumference, cm	17	96.9±9.3	17	96.1±10.0
Body fat (%)	36	29.7±6.9	36	29.3±7.9
Fat mass, kg	11	26.4±6.8	11	26.7±7.2
Lean mass, kg	20	50.9±11.2	20	49.4±11.1
Resting hemodynamics				
Systolic BP, mm Hg	71	126.7±10.3	70	126.3±9.4
Diastolic BP, mm Hg	71	76.8±8.7	70	76.5±8.6
Mean arterial pressure, mm Hg	71	93.2±8.0	70	93.2±8.2
Pulse pressure, mm Hg	71	49.4±8.3	70	49.8±6.8
Heart rate, beats/min	41	70.1±6.9	40	69.1±7.3
Strength and fitness measures[#,**]				
Upper body strength, kg	18	44.5±31.3	10	43.4±36.5
Lower body strength, kg	24	92.3±58.8	16	97.3±69.7
Cardiorespiratory fitness, mL/kg per minutes	24	28.6±9.9	23	29.7±9.4

Statistics are summarized as mean±SD, or the number of participants and proportion of the total RT and control samples, n (%). BMI indicates body mass index; BP, blood pressure; CVD, cardiovascular disease; k, number of observations; RT, resistance training.

*Participation in <30 minutes of moderate intensity, physical activity on ≤2 days/week;[130] in the absence of physical activity data, samples that were reported as "sedentary" were also included.

[†] BP classification published in the Seventh Report of the Joint National Committee.[131]

[‡] Samples were free from CVD-related chronic diseases or health conditions.

[§] Studies that reported CVD-related chronic diseases or health conditions among subjects (or medications used to treat diseases/conditions) were categorized based on the total number reported in their sample (ie, 1, 2 to 3, or ≥4; ranging from 1 to 5).[31,46]

[‖] Chronic diseases/health conditions[130] were not mutually exclusive (ie, subjects could have 1 or more); health conditions included hypertension, metabolic syndrome (MetS), and obesity, dyslipidemia (ie, CVD risk factors); chronic diseases: type 2 diabetes mellitus (T2DM), chronic heart failure, and nonalcoholic fatty liver disease (ie, CVD or metabolic diseases).

[¶] The most commonly reported combinations included: hypertension, MetS, or dyslipidemia with T2DM (see Table S5 for individual study details).

[#] Upper/lower body strength was reported for 25 of 33 RT and 14 of 24 control groups, respectively; only those reported in kilograms (kg) are summarized.

**Baseline fitness was reported for 37 RT and 36 control groups; only relative oxygen uptake assessed by peak or maximal tests are summarized.

than hypertension (7 studies; N=161);[36,55,90,91,101,114,118] 11 studies (17.2%) reported a clustering of ≥2 chronic diseases and/or health conditions among their sample (see Tables 1 and S3).

Of the 9 studies that reported race/ethnicity (N=446), 6 included all[37] or predominantly (80–96%)[36,40–42] white participants (N=274), 3[24,38,39] included Hispanic/Latino and/or Caribbean participants (N=137), 2 studies[36,41] included a small proportion of African American/Black participants (N=9), and 5[21,36,40,42] included "other" participants (N=25; Table S3). When we combined the reported *and* estimated race/ethnicity determinations, the included studies yielded a diverse sample that consisted of 56.7% white (N=1329) and 43.3% non-white samples (N=1015), that is, 21.2% Hispanic/Latino (N=497), 20.9% Asian (N=490), and 1.2% Black (N=28). Baseline sample characteristics were similar between the dynamic RT and control groups (Table 1).

Dynamic RT Intervention Characteristics

Table 2 summarizes the features of the RT interventions. Dynamic RT was performed 2.8±0.6 days/week for 14.4±7.9 weeks using moderate loads/intensity that corresponded to 65% to 70% of 1 repetition maximum (1-RM), averaging 64.7±13.0% of 1-RM. RT programs generally targeted the whole body (91%), but varied widely in their prescription of other acute program variables (eg, RT protocols consisted of 1–5 sets/exercise of 5–30 repetitions/set for 1–16 RT exercises/session; Table 2). On average, dynamic RT programs prescribed 2.8±0.9 sets of 11.0±3.8 repetitions for 7.9±2.9 dynamic RT exercises per session. One-fourth of studies (27%) failed to disclose the level of supervision during the dynamic RT intervention; of those that did, 63% reported direct supervision. The overall adherence to dynamic RT was high (92.3%±8.9%), but adherence was only reported in 65% of the studies.

Resting BP Assessment

Most interventions reported the instrument used to assess BP (81.7%), with BP most commonly measured in the seated (42.3%) or supine (26.8%) position. Yet, ≈69% of the dynamic RT interventions did not report these details (see Table S6).

Dynamic RT as Stand-Alone Antihypertensive Therapy

Small-to-moderate reductions in SBP (d_+=−0.31; 95% CI, −0.43, −0.19; −3.0 mm Hg) and DBP (d_+=−0.30; 95% CI, −0.38, −0.18; −2.1 mm Hg) were observed following dynamic RT versus control, although effect sizes for SBP (I^2=51%; 95% CI, 36–63%) and DBP (I^2=35%; 95% CI, 13–52%) lacked homogeneity (see Figure S3 for contour-enhanced funnel plots, a visual display of the effect-size distribution). Table S7 summarizes the weighted mean effect size and tests for homogeneity for the control, dynamic RT, and dynamic RT versus control.

Moderator Analyses: Multiple Moderator Models

Multiple moderator SBP model

SBP reductions were greater among studies involving samples with higher resting SBP (*P*=0.011), which occurred in a dose-response fashion: 5.7 mm Hg for samples with hypertension, 3.0 mm Hg for samples with prehypertension, and 0.0 mm Hg for samples with normal BP. SBP was also reduced to a greater extent among studies involving non-white than white samples (*P*=0.002), and among study samples that were not taking BP medication versus those that were (*P*=0.034). Greater SBP reductions occurred among studies that prescribed ≥8 versus <8 dynamic RT exercises/session (*P*=0.043), and among studies that examined BP as a primary outcome versus those that did not (*P*=0.032; Table 3). Collectively, these study-level moderators accounted for ≈67% of the variance in the BP response to dynamic RT.

Additive SBP model

Dynamic RT elicited the greatest *potential* SBP benefit among studies that included samples with untreated hypertension and prescribed ≥8 dynamic RT exercises/session (−11.8 mm Hg; 95% CI, −16.0, −7.4), an effect that was significantly greater among studies involving non-white than white samples (see additive SBP model, bottom of Table 3).

Multiple moderator DBP model

DBP reductions were greater among studies involving samples with higher resting DBP (*P*=0.023): 5.2 mm Hg for samples with hypertension, 3.3 mm Hg for samples with prehypertension, and 1.0 mm Hg for samples with normal BP, and among study samples not taking BP medications versus those that were (*P*=0.028). Greater DBP reductions occurred among studies that prescribed dynamic RT ≥3 versus <3 days/week (*P*=0.02), and among studies that achieved lower than higher methodological study quality (*P*=0.019; Table 4). Collectively, these study-level moderators accounted for ≈50% of the variance in the BP response to dynamic RT.

Additive DBP model

Dynamic RT elicited the greatest *potential* DBP benefit among studies that included samples with untreated hypertension and prescribed dynamic RT ≥3 days/week (−9.9 mm Hg; 95% CI, −13.9, −5.9), an effect that was slightly more

Table 2. Summary of Dynamic RT Intervention Characteristics (k=71)

Program Characteristics	k	Mean±SD	Range	Median
Participants (n) at baseline	71	21.1±14.9	8.0, 72.0	15.0
Participants (n) post-RT	71	18.4±11.4	8.0, 60.0	14.0
Attrition in RT group (%)	71	8.5±13.1	0.0, 53.0	0.0
Exercise adherence (%)	46	92.3±8.9	60.0, 100.0	95.0
Dynamic RT FITT				
Length (weeks)	71	14.4±7.9	6.0, 48.0	12.0
Frequency (days/week)	71	2.8±0.6	2.0, 5.0	3.0
Intensity or Load				
% of 1-RM	38	64.7±13.0	30.0, 87.5	65.0
% of MVC	2	90.0±14.4	80.0, 100.0	
10 to 15 RM	8	12.6%		
8 to 12 RM	8	12.5%		
6 to 16 RM	2	3.1%		
OMNI-RT Scale	2	3.1%		
Theraband (not specified)	3	4.7%		
% of 1-RM (estimated)*	63	67.2±12.4	30.0, 100.0	70.0
MET (estimated)†	71	4.7±1.8	2.8, 8.5	3.8
Time (total work/session)				
Number of exercises/session	69	7.9±2.9	1.0, 16.0	7.0
Number sets/exercise	67	2.8±0.9	1.0, 5.0	3.0
Number repetitions/set	65	11.0±3.8	5.0, 30.0	10.0
Rest interval/recovery (s)	30	96.3±43.3	15.0, 180.0	90.0
Type of RT protocol				
Conventional RT	54	76.0%		
Circuit-style RT	10	14.3%		
Theraband	4	5.7%		
Ankle or shin weights	2	2.9%		
Muscle groups targeted				
Upper and lower body	63	91.3%		
Lower body	4	5.8%		
Unilateral, upper body	2	2.9%		

% indicates percentage; FITT, frequency, intensity, time, and type; k, number of observations; MET, metabolic equivalent unit; MVC, maximum voluntary contraction; Range, minimum, maximum values; Reps, repetitions; RM, repetition maximum; RT, resistance training; s, seconds.

*% of 1-RM was estimated for studies that reported RT intensity/load as 1-RM range or MVC (%); represents the mean 1-RM (%) after combining the estimated and reported values (k=38).

†Standardized estimate of RT intensity/load; METs were assigned to all RT interventions so that RT intensity/loads could be quantified across studies, including unreported data (k=12) and units other than 1-RM or MVC (k=39).

pronounced among studies involving non-white than white samples (see additive DBP model, bottom of Table 4).

Discussion

Our meta-analysis aimed to determine the efficacy of dynamic RT as stand-alone antihypertensive therapy and identify potential moderators of BP response to provide insight into the optimal dose of dynamic RT to lower BP among adult populations with high BP. Consistent with past meta-analyses,[5,8–10,12] we found that moderate-intensity dynamic RT, on average, reduced BP ≈2 to 3 mm Hg compared to control (*Ps*<0.001). Importantly, our moderator analyses revealed new study-level findings that merit further comment.

Our meta-analysis revealed that dynamic RT can elicit BP reductions that are comparable to, and in some cases greater

Table 3. Multiple Moderator Model: SBP Response to Dynamic RT (k=69)*

<table>
<tr><th colspan="2">Moderator Dimension/Level</th><th>$\widehat{d}_+$ (95% CI)[†]</th><th>β</th><th>P Value</th><th>SBP Δ (mm Hg)[‡]</th></tr>
<tr><td colspan="2">Resting SBP of RT sample, mm Hg</td><td></td><td>−0.311</td><td>0.011</td><td></td></tr>
<tr><td colspan="2">Normal=115±11 (k=16)</td><td>0.00 (−0.23, 0.23)</td><td></td><td></td><td>0.0 (−2.5, 2.5)</td></tr>
<tr><td colspan="2">Prehypertension=130±13 (k=41)</td><td>−0.23 (−0.39, −0.07)</td><td></td><td></td><td>−3.0 (−5.1, −1.0)[§]</td></tr>
<tr><td colspan="2">Hypertension=142±14 (k=14)[¶]</td><td>−0.41 (−0.64, −0.19)</td><td></td><td></td><td>−5.7 (−9.0, −2.7)[§,‖]</td></tr>
<tr><td colspan="2">Race/ethnicity of RT sample</td><td></td><td>0.354</td><td>0.002</td><td></td></tr>
<tr><td colspan="2">White samples (k=40)</td><td>−0.00 (−0.20, 0.20)</td><td></td><td></td><td>0.0 (−2.6, 2.6)</td></tr>
<tr><td colspan="2">Nonwhite samples (k=31)[¶]</td><td>−0.36 (−0.56, −0.16)</td><td></td><td></td><td>−4.7 (−7.3, −2.1)[§]</td></tr>
<tr><td colspan="2">BP medication use of RT sample</td><td></td><td>0.261</td><td>0.034</td><td></td></tr>
<tr><td colspan="2">Taking BP medication (k=14)</td><td>−0.03 (−0.29, 0.23)</td><td></td><td></td><td>−0.4 (−3.8, 3.0)</td></tr>
<tr><td colspan="2">Not taking BP medication (k=57)[¶]</td><td>−0.33 (−0.48, −0.17)</td><td></td><td></td><td>−4.3 (−6.2, −2.2)[§]</td></tr>
<tr><td colspan="2">RT exercises performed/session</td><td></td><td>−0.221</td><td>0.043</td><td></td></tr>
<tr><td colspan="2"><8 RT exercises=6 (k=37)</td><td>−0.11 (−0.29, 0.08)</td><td></td><td></td><td>−1.4 (−4.4, 1.0)</td></tr>
<tr><td colspan="2">≥8 RT exercises=12 (k=32)[¶]</td><td>−0.34 (−0.55, −0.12)</td><td></td><td></td><td>−4.4 (−7.2, −1.6)[§]</td></tr>
<tr><td colspan="2">Primary study outcome</td><td></td><td>−0.238</td><td>0.032</td><td></td></tr>
<tr><td colspan="2">BP focused outcome (k=34)[¶]</td><td>−0.30 (−0.49, −0.10)</td><td></td><td></td><td>−3.9 (−6.4, −1.3)[§]</td></tr>
<tr><td colspan="2">Non-BP focused outcome (k=37)</td><td>−0.06 (−0.26, 0.14)</td><td></td><td></td><td>−0.8 (−3.4, 1.8)</td></tr>
<tr><td rowspan="2">Additive SBP model[¶]</td><td>Non-white samples</td><td>−1.02 (−1.36, −0.67)</td><td></td><td></td><td>−14.3 (−19.0, −9.4)</td></tr>
<tr><td>White samples</td><td>−0.66 (−0.97, −0.35)</td><td></td><td></td><td>−9.2 (−13.6, −4.9)</td></tr>
</table>

Resting SBP is presented as mean±SD. Δ indicates change; BP, blood pressure; k, number of observations; RT, resistance training; SBP, systolic BP; β, standardized coefficient represents unique variance explained by moderator.

*Multiple R^2 (variance explained by model, adjusted for number of moderators)=67.1%; I^2 residual (variance unexplained by model)=27.3%.

[†] Predicted weighted mean effect size (d_+); estimate of the magnitude of SBP reduction among the RT group relative to control, while statistically controlling for the presence of each moderator shown in the above model (held constant at their mean), except for moderator/level of interest. This model also controls for (not shown): 1 versus 2 RT groups (β=−0.235; P=0.050) and SBP×RT exercises interaction (β=0.174; P=0.133).

[‡] SBP $\Delta=\widehat{d}_+$ (95% CIs) back-converted to mm Hg. For each moderator/level of interest, $\widehat{d}_+$ (95% CIs) were transformed arithmetically using the SD corresponding to the sample mean (130±13 mm Hg): $\Delta=\widehat{d}_+$ (95% CI)×13 mm Hg, with the exception of normal SBP: $\Delta=\widehat{d}_+$ (95% CI)×11 mm Hg; hypertension SBP and additive SBP model: $\Delta=\widehat{d}_+$ (95% CI)×14 mm Hg.

[§] ($P<0.05$): normal SBP; white samples; taking medication; 6 exercises; non-BP outcome.

[‖] Normal and prehypertension SBP.

[¶] Indicates the moderator dimensions/levels that conferred the largest SBP reductions and were used to generate the additive SBP model.

than, those that have been previously reported with AE among study samples with hypertension.[3–6] Notably, we found that BP reductions following dynamic RT occurred in dose-response fashion, such that studies involving samples with hypertension yielded the largest BP reductions (≈6/5 mm Hg), followed by samples with prehypertension (≈3/3 mm Hg), and then samples with normal BP (≈0/1 mm Hg; *Ps*≤0.023). Furthermore, studies involving non-white (ie, Hispanic/Latino and Asian) samples with hypertension experienced even larger BP reductions that were approximately double the magnitude reportedly achieved with AE (≈10–14 vs 5–7 mm Hg).[3–6] Our findings should be confirmed using participant-level data and investigated further in primary-level studies. Nonetheless, they suggest that the present exercise recommendations for hypertension should be revisited to include dynamic RT *in addition to* AE as stand-alone antihypertensive lifestyle therapy.

Our results add other new information to the literature by identifying clinically important study-level moderators of BP response to dynamic RT. One of our most noteworthy findings was that dynamic RT elicited BP reductions in dose-response fashion, which aligns with reports for AE training,[3–5] but conflicts with other aggregate-level meta-analyses examining the BP response to dynamic RT. Reasons for the differences between our meta-analysis and others are not completely clear, but may reside in the fact that we performed one of the largest and most comprehensive electronic searches to date, included RCT and non-RCTs, identified 3 times the number of dynamic RT studies that involved adults with high BP (51 studies; N=1968) than previously reported (16 studies; N=617)[12] and adhered to high-quality, contemporary standards.[3,13–15]

Another important distinction between ours and previously published meta-analyses[7–12] is that we applied less common, but more sophisticated, contemporary approaches, such as multiple moderator meta-regressions,[16,18,19] interactive modeling strategies,[51] and the moving constant technique.[67] In contrast, past meta-analyses have almost exclusively used

Table 4. Multiple Moderator Model: DBP Response to Dynamic RT (k=71)*

Moderator Dimension/Level		$\widehat{d}_+$ (95% CI)[†]	β	*P* Value	DBP Δ (mm Hg)[‡]
Resting DBP of RT sample, mm Hg			−0.317	0.023	
Normal=69±7 (k=16)		−0.13 (−0.30, 0.31)			−0.9 (−2.1, 2.2)
Prehypertension=83±9 (k=41)		−0.37 (−0.59, −0.15)			−3.3 (−5.3, −1.4)[§]
Hypertension=92±10 (k=14)[¶]		−0.52 (−0.84, −0.19)			−5.2 (−8.4, −1.9)[§]
BP medication use of RT sample			0.260	0.028	
Currently taking BP medication (k=14)		−0.13 (−0.38, 0.11)			−1.2 (−3.4, 1.0)
Not taking BP medication (k=57)[¶]		−0.39 (−0.55, −0.23)			−3.5 (−5.0, −2.1)[§]
Frequency of RT sessions			−0.262	0.020	
<3 days=2 days weekly (k=22)		−0.10 (−0.31, 0.11)			−0.9 (−2.8, 1.0)
≥3 days=4 days weekly (k=49)[¶]		−0.50 (−0.76, −0.23)			−4.5 (−6.8, −2.1)[§]
Methodological study quality			0.296	0.019	
Lower quality=49% satisfied (k=25)[¶]		−0.41 (−0.62, −0.19)			−3.7 (−5.6, −1.7)[‖]
Moderate quality=63% satisfied (k=35)		−0.20 (−0.38, −0.03)			−1.8 (−3.4, −0.3)[§]
Higher quality=82% satisfied (k=11)		−0.03 (−0.28, 0.22)			−0.3 (−2.5, 2.0)
Additive DBP model[¶]	Non-white samples	−1.03 (−1.45, −0.62)			−10.3 (−14.5, −6.2)
	White samples	−0.95 (−1.35, −0.54)			−9.5 (−13.5, −5.2)

Resting DBP is presented as mean±SD. Δ indicates change; BP, blood pressure; DBP, diastolic blood pressure; k, number of observations; RT, resistance training; β, standardized coefficient represents unique variance explained by moderator.

[*] Multiple R^2 (variance explained by model, adjusted for number of moderators)=49.9%; I^2 residual (variance unexplained by model)=19.6%.

[†] Predicted weighted mean effect size (d_+); estimate of the magnitude of DBP reduction among the RT group relative to control, while statistically controlling for the presence of each moderator shown in the above model (held constant at their mean), except for the moderator/level of interest. This model also controls for (not shown): race/ethnicity (β=0.097; *P*=0.382), 1 versus 2 RT groups (β=−0.017; *P*=0.902), and DBP×RT groups interaction (β=0.248; *P*=0.056).

[‡] DBP $\Delta=\widehat{d}_+$ (95% CIs) back-converted to mm Hg. For each moderator/level of interest, $\widehat{d}_+$ (95% CIs) were transformed arithmetically using the SD corresponding to the sample mean (83±9 mm Hg): $\Delta=\widehat{d}_+$ (95% CI)×9 mm Hg, with the exception of normal DBP: $\Delta=\widehat{d}_+$ (95% CI)×8 mm Hg; hypertension DBP and additive DBP model: $\Delta=\widehat{d}_+$ (95% CI)×10 mm Hg.

[§] ($P<0.05$): normal DBP; taking medication; 2 days/week; higher quality.

[‖] Moderate and higher quality.

[¶] Indicates the moderator dimensions/levels that conferred the largest DBP reductions and were used to generate the additive DBP model.

subgroup or univariate meta-regression analyses to investigate potential study-level moderators. These 2 approaches consider moderators *individually* rather than *collectively*,[16,18,19] which is problematic not only because meta-analysis is correlational in nature,[16,18] but also because the BP response to exercise is complex and is likely influenced by many factors at both the study and individual level.[130] Assessing multiple study-level moderators in a single meta-regression model is the preferred method because it allows sample, RT intervention, and study-quality moderators that explain unique variance in the BP response to exercise to be isolated with greater precision and confidence.[16,18,19,51,68] Furthermore, the use of contemporary strategies, in particular the moving constant technique,[67] can estimate the magnitude of BP reduction at different levels of individual moderators, thus providing more precise estimates that can facilitate interpretation of their clinical significance.

Our meta-analysis is the first in the exercise and BP literature to incorporate methodological study quality *quantitatively* to determine whether it independently[3,13] or interactively[51] modulates the BP response to dynamic RT. We found that BP reductions were greater among studies that achieved lower than higher methodological quality, although there was a paucity of higher-quality dynamic RT studies in this literature, with only 7 satisfying ≥80% of quality items. We also found that, despite overall quality, greater BP reductions occurred among studies that examined BP as a primary outcome.

We, along with past meta-analyses,[10–12] have found this literature to be of “fair-to-moderate” methodological study quality.[47,48] In the absence of a higher-quality literature, there is the potential risk of bias or other threats to validity. Therefore, in addition to assessing and controlling for methodological study quality and whether studies had BP-focused outcomes in our multiple moderator models, we examined other sources of potential bias. We found that higher methodological quality was associated with more-recent studies (*r*=0.45; $P<0.001$), RCTs (*r*=0.23; *P*=0.052), studies that were adequately powered to detect BP outcomes (*r*=0.41; $P<0.001$), involved 1 dynamic RT intervention (vs multiple; *r*=0.22; *P*=0.069), and followed established BP assessment protocols (*r*=0.24; *P*=0.045). Despite their association with methodological study quality, none of these potential biases modulated the BP response to dynamic RT. Nonetheless, they were incorporated in analyses, when feasible, to control for confounding or suppression effects that could arise from lower-quality studies.[3,51] By examining the potential risk of bias from several sources and incorporating them into our multiple moderator models, we can be more confident in our results, despite the number of methodological deficits and inconsistencies in this literature.[51]

Our moderator analyses also addressed other important gaps in this literature. No meta-analysis conducted to date, until ours, has identified features of the dynamic RT intervention that influences the BP response to dynamic RT. We found that dynamic RT protocols performed, on average, 3 days/week using low-to-moderate loads/intensity (≈60–65% 1-RM), consisting of 3 sets of 10 to 12 repetitions for ≈8 (3–4 upper and 4–5 lower body) exercises significantly reduced resting BP ≈5 to 6 mm Hg among studies that included samples with hypertension. We observed even larger BP reductions among studies that prescribed dynamic RT ≥3 versus <3 days/week and ≥8 versus <8 RT exercises/session. Our findings are in agreement with the current exercise recommendations for hypertension, and provide some of the first study-level evidence regarding the FIT components of the dynamic RT prescription for adult populations with high BP. Nonetheless, important characteristics of the dynamic RT intervention (eg, progression, load/intensity, rest/recovery duration) were inconsistently or poorly reported. Therefore, the dynamic RT protocol that elicits the most favorable BP benefits for adult populations with hypertension remains elusive.

We also identified study-level sample characteristics that suggests there may be particular populations that could benefit the most from dynamic RT as stand-alone antihypertensive therapy. Namely, BP reductions were greater among study samples that were not taking antihypertensive medications compared to those that were (≈4 vs 1 mm Hg), independent of baseline BP. This finding is potentially promising because of the synergistic effect between antihypertensive medication and the magnitude of BP reductions following dynamic RT that have been reported by some,[25,132,133] but not all, studies.[22,121,122] Nonetheless, these findings should be interpreted with caution given the small proportion of dynamic RT studies that reported antihypertensive medication use in their sample (≈15%), and the generally poor reporting of medication use in this literature (unreported by ≈33%).

Interestingly, we found that dynamic RT studies involving non-white (ie, Asian, Hispanic/Latino, and Black) samples with hypertension elicited BP reductions of 10 to 14 mm Hg, approximately double the magnitude that has been previously reported to occur as a result of AE training among predominately white populations (ie, 5–7 mm Hg).[3–6] To the best of our knowledge, only 1 meta-analysis[43] has investigated the potential impact of race/ethnicity on the BP response to exercise training. Whelton et al[43] found that AE training reduced resting BP to greater levels among Asian (6/7 mm Hg) and Black (11/3 mm Hg) compared to white samples (3/3 mm Hg; $P<0.05$). In follow-up analyses (not shown), we observed a similar non-significant trend where greater SBP reductions occurred among studies that included Hispanic/Latino (≈13/10 mm Hg) and Asian (≈11/10 mm Hg) compared to white samples (≈9/10 mm Hg).

The potential mechanisms underlying the greater BP-lowering benefits resulting from dynamic RT among non-white than white samples are beyond the scope of our meta-analysis, and should be interpreted with some caution because we estimated race/ethnicity based on the study location for ≈86% of included studies. Nonetheless, we examined racial/ethnic differences in baseline study-level characteristics to determine whether these covariates could provide additional insight to our findings. Despite similar baseline BP (white: 128.0±9.9/76.9±8.9 mm Hg vs non-white: 125.0±10.6/76.6±8.7 mm Hg; $Ps \geq 0.90$), we found that body mass index was higher among studies with white than non-white samples (27.9±0.5 vs 25.6±0.6 kg/m^2; P=0.01), and waist circumference tended to be greater among non-white than white study samples (100.1±8.2 vs 92.2±9.5 cm; P=0.10). However, these study-level covariates did not emerge as moderators of BP response to dynamic RT, perhaps in part, because they were poorly reporting across interventions (body mass index, k=60; waist circumference, k=17). Therefore, follow-up analyses did not provide any additional insight into our findings as to why greater antihypertensive effects were observed among RT studies that included non-white than white samples.

Limitations, Strengths, and Future Directions

Our meta-analysis is not without limitations. The broader selection criteria, which permitted RCTs and non-RCTs and studies that included samples with and without CVD-related chronic diseases and health conditions, may limit our ability to directly compare our findings against previous meta-analyses. On the other hand, subsequent analyses did not reveal that randomization or inclusion of study samples with CVD-related chronic diseases or health conditions significantly modulated the BP response to dynamic RT. Moreover, our multiple moderator models controlled for potential biases that could have been introduced by including studies presumed to be of “lower quality” (ie, non-RCTs). We must also acknowledge that estimating race/ethnicity based on the geographical location of the study is a limitation of our meta-analysis, but more importantly, a limitation of primary-level studies in this literature.[134–136] We estimated race/ethnicity only when it was *unreported* in the original article; unfortunately, this was the case for the majority of our sample. Nonetheless, we employed the same methodology used by Whelton et al[43] and 2 recent meta-analyses that examined differences in prevalence of high BP[45] and diabetes mellitus[44] between racial/ethnic minority groups. Finally, our results should be interpreted with some caution because the effect modifiers we observed using study-level moderators may not be confirmed in future studies using individual participant-level.[137,138]

Our meta-analysis also has several strengths. In addition to fully satisfying contemporary methodological standards, our meta-analysis is one of the largest, most comprehensive meta-analyses conducted on this topic to date. We included 64 controlled studies (71 interventions) that involved 2374 participants, of which 1968 had pre- to established hypertension. Second, we expanded upon previous meta-analyses by applying more sophisticated, contemporary approaches (ie, multiple moderator meta-regressions[16,18,19]) and innovative techniques (ie, interactive modeling strategies[51] and the moving constant technique[67]) that enabled us to identify novel study-level moderators that explained a clinically meaningful proportion of the variance in the BP response to dynamic RT (ie, 50–67%). Third, our meta-analysis incorporated methodological study quality and other potential biases (ie, BP-focused outcomes) into our multiple moderator models; therefore, we can be more confident in the robustness of our findings despite the methodological limitations of this literature. Last, our results may also help to optimize future research efforts by documenting where knowledge is the weakest or poorly reported, generating new hypotheses about what dose of dynamic RT elicits optimal antihypertensive benefits for particular patient populations, and highlighting which research areas warrant additional investigation.

Conclusions

In summary, our meta-analysis, which adhered to high-quality, contemporary methodological standards, revealed that dynamic RT can elicit BP reductions that are comparable to, or greater than, those reportedly achieved with AE among samples with hypertension. A novel finding was that dynamic RT conferred the greatest antihypertensive benefit among studies that included non-white samples with hypertension that were not taking BP-lowering medication; BP reductions that were double in magnitude to those reported as a result of AE training. Despite our new and exciting findings, this literature has limitations and is of only fair-to-moderate quality. Additional RCTs that adequately report the characteristics of their sample, dynamic RT intervention features, and BP assessment methods are needed to confirm our findings. Nonetheless, our results indicate that RT should be further investigated as a viable lifestyle therapeutic option for adult populations with hypertension, and the present exercise recommendations for hypertension should be revisited to include dynamic RT *in addition to* AE as stand-alone antihypertensive lifestyle therapy.

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Disclosures

None.

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SUPPLEMENTAL MATERIAL

Data S1: Full search strategy for each of the five electronic databases queried: PubMed, Scopus (including EMBASE), Web of Science, SPORTDiscus, and CINAHL (Cumulative Index to Nursing and Allied Health Literature). For each search listed below, no start date was applied, and databases were searched from their inception or date of the earliest available publication.

PubMed (including MEDLINE) Vendor/Platform: National Library of Medicine	Coverage: Date of inception 1940's – January 31, 2014 Hits: 8, 417

PubMed was searched with appropriate Medical Subject Headings (MeSH) incorporated into hedges. Filters were set for Humans:

("mean arterial" OR "blood pressure"[mesh] OR "blood pressure" OR "blood pressures" OR "arterial pressure" OR "arterial pressures" OR hypertension OR hypotension OR normotension OR hypertensive OR antihypertensive OR hypotensive OR normotensive OR "systolic pressure" OR "diastolic pressure" OR "pulse pressure" OR "venous pressure" OR "pressure monitor" OR hypotension OR "pre hypertension" OR "bp response" OR "bp decrease" OR "bp reduction" OR "bp monitor" OR "bp monitors" OR "bp measurement")

AND ("exercise"[majr] OR exercise[ti] OR exercises[ti] OR exercising[ti] OR postexercise[ti] OR running[mesh] OR running[ti] OR bicycling[mesh] OR bicycling OR bicycle* OR cycling[ti] OR treadmill* OR ergometer* OR "weight lifting" OR "weight training" OR "resistance training" OR "strength training" OR "endurance training" OR "speed training" OR "circuit training" OR "training duration" OR "training frequency" OR "training intensity" OR "aerobic endurance" OR "aerobic training" OR "interval training" OR "combination training" OR "combined training" OR plyometric* OR "HIIT" OR walking[mesh] OR walking[ti] OR swimming)

AND ("randomized controlled trial"[pt] OR "controlled clinical trial"[pt] OR "random allocation" [mh] OR "clinical trial"[pt] OR "clinical trial"[tw] OR "latin square"[tw] OR random*[tw] OR "research design" [mh:noexp] OR "comparative study"[publication type] OR "evaluation studies"[publication type] OR "prospective studies" [mh] OR "cross-over studies" [mh] OR control[tw] OR controlled[tw])

NOT ("DASH"[tiab] OR cancer OR neoplasms OR review[pt] OR fibromyalgia OR alzheimers OR alzheimer OR pregnant OR pregnancy OR "obesity/drug therapy"[mesh] OR pharmacol*[ti] OR drug[ti] OR pharmacist*[ti] OR "diet therapy"[mesh] OR "diet therapy"[subheading] OR "nutritional intervention" OR "dietary intervention" OR "nutritional counseling" OR "dietary counseling" OR caffeine OR "eating change" OR "activities of daily living" OR "dehydration" OR "dehydrate" OR "dehydrated" OR "dietary salt" OR sodium OR epilepsy OR influenza OR flu OR pneumonia OR septicemia OR arthritis OR hiv OR "Acquired Immunodeficiency Syndrome" OR meningitis OR "substance abuse" OR alcoholism OR "drug abuse" OR "Cross-Sectional Studies"[MeSH Terms] OR "Case Reports"[pt] OR Comment[pt] OR Editorial[pt] OR Letter[pt] OR Review[pt] OR "case control"[ti] OR "case report"[ti] OR "case study"[ti] OR "case series"[ti] OR "Case-Control Studies"[Mesh] OR "Follow-Up Studies"[Mesh] OR "observational study"[ti] OR "prospective cohort"[ti] OR "cohort studies" [Mesh:NoExp] OR "cohort study"[ti] OR "Longitudinal Studies" [Mesh:NoExp] OR "Follow-Up Studies"[mesh] OR "Retrospective Studies"[mesh] OR "follow up study"[ti] OR rat[ti] OR rats[ti] OR mice[ti] OR mouse[ti] OR dog[ti] OR dogs[ti] OR cats[ti] OR "epidemiology"[Subheading])

Scopus (including EMBASE) Vendor/platform: Elsevier SciVerse	Search dates: Date of inception 1960 – January 31, 2014 Hits: 9, 354

Scopus was searched for the following terms in the "Article title, abstract, keywords." Filters were set for Document Type, excluding: Review, Letter, Note, Editorial.

Line 1 (in article, title, abstract, keywords): ({mean arterial} OR {blood pressure} OR {blood pressures} OR {arterial pressure} OR {arterial pressures} OR hypertension OR hypotension OR normotension OR hypertensive OR hypotensive OR normotensive OR {systolic pressure} OR {diastolic pressure} OR {pulse pressure} OR {venous pressure} OR {pressure monitor} OR hypotension OR {pre hypertension} OR {bp response} OR {bp decrease} OR {bp reduction} OR {bp monitor} OR {bp monitors} OR {bp measurement})

AND Line 2 (in article, title, abstract, keywords): (bicycling OR bicycle* OR treadmill* OR ergometer* OR {weight lifting} OR {weight training} OR {resistance training} OR {strength training} OR {endurance training} OR {speed training} OR {circuit training} OR {training duration} OR {training frequency} OR {training intensity} OR {aerobic endurance} OR {aerobic training} OR {interval training} OR {combination training} OR {combined training} OR plyometric* OR HIIT OR swimming)

OR Line 3 (in article title): (exercise OR exercises OR exercising OR postexercise OR running OR cycling OR walking)

AND Line 4 (in article, title, abstract, keywords): ({clinical trial} OR {latin square} OR random* OR {comparative study} OR {evaluation study} OR {evaluative study} OR {prospective study} OR {cross-over study} OR control OR controlled)

NOT Line 5 (in article, title, abstract, keywords): (DASH OR cancer OR neoplasms OR fibromyalgia OR alzheimer* OR pregnant OR pregnancy OR {nutritional intervention} OR {diet therapy} OR {dietary intervention} OR {nutritional counseling} OR {dietary counseling} OR caffeine OR {eating change} OR {activities of daily living} OR dehydration OR dehydrate OR dehydrated OR {dietary salt} OR sodium OR epilepsy OR influenza OR flu OR pneumonia OR septicemia OR arthritis OR hiv OR {Acquired Immunodeficiency Syndrome} OR meningitis OR {substance abuse} OR alcoholism OR {drug abuse})

OR Line 6 (in article title): (review OR pharmacol* OR drug OR pharmacist* OR {cross-sectional} OR {case report} OR comment OR commentary OR editorial OR letter OR {case control} OR {case study} OR {case series} OR {follow-up study} OR {observational study} OR {prospective cohort} OR {cohort study} OR {longitudinal study} OR {retrospective study} OR rat OR rats OR mice OR mouse OR dog OR dogs OR cats OR {epidemiology})

Web of Science (i.e., Web of Knowledge) Vendor/platform: Thomson Reuters	Coverage: Earliest date available 1974 – January 31, 2014 Hits: 3, 658

Web of Science was searched using the following terms as “Topic” words. Filters were set for Document Type, including only: Articles, Proceedings Papers. Due to database limitations, excluded terms (i.e., “NOT” terms) were only searched in the article titles, and was performed using RefWorks.

Line 1 (in topic): ("mean arterial" OR "blood pressure" OR "blood pressures" OR "arterial pressure" OR "arterial pressures" OR hypertension OR hypotension OR normotension OR hypertensive OR hypotensive OR normotensive OR "systolic pressure" OR "diastolic pressure" OR "pulse pressure" OR "venous pressure" OR "pressure monitor" OR hypotension OR "pre hypertension" OR "bp response" OR "bp decrease" OR "bp reduction" OR "bp monitor" OR "bp monitors" OR "bp measurement")

AND Line 2 (in topic): (bicycling OR bicycle* OR treadmill* OR ergometer* OR "weight lifting" OR "weight training" OR "resistance training" OR "strength training" OR "endurance training" OR "speed training" OR "circuit training" OR "training duration" OR "training frequency" OR "training intensity" OR "aerobic endurance" OR "aerobic training" OR "interval training" OR "combination training" OR "combined training" OR plyometric* OR HIIT OR swimming)

OR Line 3 (in article title): (exercise OR exercises OR exercising OR postexercise OR running OR cycling OR walking)

AND Line 4 (in topic): ("clinical trial" OR "latin square" OR random* OR "comparative study" OR "evaluation study" OR "evaluative study" OR "prospective study" OR "cross-over study" OR control OR controlled)

NOT Line 5 (in title): (DASH OR cancer OR neoplasms OR fibromyalgia OR alzheimer* OR pregnant OR pregnancy OR "nutritional intervention" OR "diet therapy" OR "dietary intervention" OR "nutritional counseling" OR "dietary counseling" OR caffeine OR "eating change" OR "activities of daily living" OR dehydration OR dehydrate OR dehydrated OR "dietary salt" OR sodium OR epilepsy OR influenza OR flu OR pneumonia OR septicemia OR arthritis OR hiv OR "Acquired Immunodeficiency Syndrome" OR meningitis OR "substance abuse" OR alcoholism OR "drug abuse" OR review OR pharmacol* OR drug OR pharmacist* OR "cross-sectional" OR "case report" OR comment OR commentary OR editorial OR letter OR "case control" OR "case study" OR "case series" OR "follow-up study" OR "observational study" OR "prospective cohort" OR "cohort study" OR "longitudinal study" OR "retrospective study" OR rat OR rats OR mice OR mouse OR dog OR dogs OR cats OR "epidemiology")

SPORTDiscus Vendor/platform: EbscoHost	Coverage: Date of inception 1975 – January 31, 2014 Hits: 537

SportDiscus was searched for the following terms as “Topic” words. Filters were set for Publication Type, including only: Journal Articles; Peer Reviewed; Academic Journals:

Line 1: ("mean arterial" OR "blood pressure" OR "blood pressures" OR "arterial pressure" OR "arterial pressures" OR hypertension OR hypotension OR normotension OR hypertensive OR hypotensive OR normotensive OR "systolic pressure" OR "diastolic pressure" OR "pulse pressure" OR "venous pressure" OR "pressure monitor" OR hypotension OR "pre hypertension" OR "bp response" OR "bp decrease" OR "bp reduction" OR "bp monitor" OR "bp monitors" OR "bp measurement")

AND Line 2: (bicycling OR bicycle* OR treadmill* OR ergometer* OR "weight lifting" OR "weight training" OR "resistance training" OR "strength training" OR "endurance training" OR "speed training" OR "circuit training" OR "training duration" OR "training frequency" OR "training intensity" OR "aerobic endurance" OR "aerobic training" OR "interval training" OR "combination training" OR "combined training" OR plyometric* OR HIIT OR swimming)

OR Line 3 (in article title): (exercise OR exercises OR exercising OR postexercise OR running OR cycling OR walking)

AND Line 4: ("clinical trial" OR "latin square" OR random* OR "comparative study" OR "evaluation study" OR "evaluative study" OR "prospective study" OR "cross-over study" OR control OR controlled)

NOT Line 5 (in title): (DASH OR cancer OR neoplasms OR fibromyalgia OR alzheimer* OR pregnant OR pregnancy OR "nutritional intervention" OR "diet therapy" OR "dietary intervention" OR "nutritional counseling" OR "dietary counseling" OR caffeine OR "eating change" OR "activities of daily living" OR dehydration OR dehydrate OR dehydrated OR "dietary salt" OR sodium OR epilepsy OR influenza OR flu OR pneumonia OR septicemia OR arthritis OR hiv OR "Acquired Immunodeficiency Syndrome" OR meningitis OR "substance abuse" OR alcoholism OR "drug abuse" OR review OR pharmacol* OR drug OR pharmacist* OR "cross-sectional" OR "case report" OR comment OR commentary OR editorial OR letter OR "case control" OR "case study" OR "case series" OR "follow-up study" OR "observational study" OR "prospective cohort" OR "cohort study" OR "longitudinal study" OR "retrospective study" OR rat OR rats OR mice OR mouse OR dog OR dogs OR cats OR "epidemiology")

CINAHL	Coverage: Date of inception 1981 – January 31, 2014
Vendor/Platform: EbscoHost	Hits: 122

CINAHL was searched with appropriate CINAHL subject headings incorporated into hedges, though not shown below, medical headings were included for “blood pressure”, “exercise”, “running”, and “weight lifting”. Filters were set for Research Article; Humans, All Adults. CINAHL hits excluded MEDLINE records.

Line 1: ("mean arterial" OR "blood pressure" OR "blood pressures" OR "arterial pressure" OR "arterial pressures" OR hypertension OR hypotension OR normotension OR hypertensive OR hypotensive OR normotensive OR "systolic pressure" OR "diastolic pressure" OR "pulse pressure" OR "venous pressure" OR "pressure monitor" OR hypotension OR "pre hypertension" OR "bp response" OR "bp decrease" OR "bp reduction" OR "bp monitor" OR "bp monitors" OR "bp measurement")

AND Line 2: (bicycling OR bicycle* OR treadmill* OR ergometer* OR "weight lifting" OR "weight training" OR "resistance training" OR "strength training" OR "endurance training" OR "speed training" OR "circuit training" OR "training duration" OR "training frequency" OR "training intensity" OR "aerobic endurance" OR "aerobic training" OR "interval training" OR "combination training" OR "combined training" OR plyometric* OR HIIT OR swimming)

OR Line 3 (in article title): (exercise OR exercises OR exercising OR postexercise OR running OR cycling OR walking)

AND Line 4: ("clinical trial" OR "latin square" OR random* OR "comparative study" OR "evaluation study" OR "evaluative study" OR "prospective study" OR "cross-over study" OR control OR controlled)

NOT Line 5 (in title): (DASH OR cancer OR neoplasms OR fibromyalgia OR alzheimer* OR pregnant OR pregnancy OR "nutritional intervention" OR "diet therapy" OR "dietary intervention" OR "nutritional counseling" OR "dietary counseling" OR caffeine OR "eating change" OR "activities of daily living" OR dehydration OR dehydrate OR dehydrated OR "dietary salt" OR sodium OR epilepsy OR influenza OR flu OR pneumonia OR septicemia OR arthritis OR hiv OR "Acquired Immunodeficiency Syndrome" OR meningitis OR "substance abuse" OR alcoholism OR "drug abuse" OR review OR pharmacol* OR drug OR pharmacist* OR "cross-sectional" OR "case report" OR comment OR commentary OR editorial OR letter OR "case control" OR "case study" OR "case series" OR "follow-up study" OR "observational study" OR "prospective cohort" OR "cohort study" OR "longitudinal study" OR "retrospective study" OR rat OR rats OR mice OR mouse OR dog OR dogs OR cats OR "epidemiology")

Data S2: Augmented version of the Downs and Black Checklist.

Individual Methodological Study Quality Items, Listed by Quality Subscale	**Y**	**N**	**UD**	**P**
† 1. Is the hypothesis/aim/objective of the study clearly described?	1	0	0	—
† 2. Are the main outcomes clearly described in the Introduction or Methods section?	1	0	0	—
* 3. Is BP a primary outcome?	1	0	0	½
‡ 4. Are the characteristics of the study population included in the study clearly described?	1	0	0	½
‡ 5. Are the interventions under study clearly described?	1	0	0	½
† 6. Are the distributions of principal confounders in each intervention clearly described?	1	0	0	½
§ 7. Are the BP findings of the study clearly described?	1	0	0	—
§ 8. Are estimates of the random variability (e.g., SE, SD, CIs) for BP outcomes reported?	1	0	0	—
‡ 9. Have all important adverse events/negative outcomes that may be a consequence of the intervention been reported? If eligibility screening was reported, award partial score.	1	0	0	½
† 10. Have the characteristics of study participants lost to follow up been described?	1	0	0	—
§ 11. Are actual probability values reported (e.g., 0.035 *vs.* <0.05) for BP outcomes except for values <0.001?	1	0	0	—
Reporting ***Items satisfied=___*** *(11 possible points)*				
† 12. Were study subjects asked to participate representative of the population from which they were recruited?	1	0	0	—
† 13. Were study subjects who agreed to participate representative of the population from which they were recruited?	1	0	0	—
† 14. Were the staff, places, and facilities where the study subjects received the intervention representative of the intervention the majority of subjects receive?	1	0	0	—
External Validity ***Items satisfied=___*** *(3 possible points)*				
§ 15. Were subjects "blinded" to their assigned intervention until recruitment and baseline/ pre-training measurements were completed and final? (i.e., subjects were unaware of the intervention they had received until these processes were complete).	1	0	0	—
§ 16. Was an attempt made to blind those measuring BP outcomes of the intervention?	1	0	0	—
† 17. If any of the results were based on "data dredging", was this made clear?	1	0	0	—
† 18. In trials and cohort studies, do analyses adjust for different lengths of follow-up of study participants, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?	1	0	0	—
† 19. Were the statistical tests used to assess the main outcomes appropriate?	1	0	0	—
§ 20. Was compliance with the intervention reliable based on reported exercise adherence, level of supervision, or use of monitoring devices?	1	0	0	—
§ 21. Were BP measurements accurate? (i.e., were measures of resting BP and/or ABP valid and reliable based on the monitor or tool and assessment procedures?)	1	0	0	½
Internal Validity – Bias ***Items satisfied=___*** *(7 possible points)*				
† 22. Were study participants in the different intervention groups (trial/cohort studies) or cases and controls (case-control studies) recruited from the same population?	1	0	0	—
† 23. Were study participants in the different intervention groups (trial/cohort studies) or cases and controls (case-control studies) recruited over the same period of time?	1	0	0	—
† 24. Were study participants randomized to intervention groups?	1	0	0	½
† 25. Was the randomized intervention assignment concealed from both study participants and intervention staff until recruitment was complete and irrecoverable?	1	0	0	—
† 26. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	1	0	0	—
† 27. Were losses of study participants to follow-up taken into account?	1	0	0	—
Internal Validity – Confounding ***Items satisfied=___*** *(6 possible points)*				
§ 28. Was a power analysis conducted to determine the sample size needed to detect a significant difference(s) in effect size for the BP or other outcome measure(s)?	1/2	0	0	—
Power ***Items satisfied=___*** *(2 possible points)*				
Total Methodological Study Quality = ______ **of 29 possible points** *(summary score)*				

Note. ABP=Ambulatory BP. BP=Blood pressure. N=No, not satisfied. P=Partially satisfied. UD=Unable to determine. Y=Yes, fully satisfied. ***** New item (not part of original checklist). **†** Original item. **‡** Clarified from original checklist.
§ Modified from original checklist. *Adapted with permission from BMJ Publishing Group Limited. [The feasibility of creating a checklist for the assessment of the methodological quality both of randomized and non-randomized studies of health care interventions, Downs SH & Black N,* Journal of Epidemiology Community Health, 52*, 377-384, ©1998].*[1]

Table S1. The antihypertensive effects of dynamic resistance training compared to control: A comparison of weighted mean effect sizes and tests for homogeneity for systolic and diastolic blood pressure generated using Stata 13.1 versus the metafor package in R (*k*=71).

Systolic BP:			**Homogeneity of *d*s §**			**BP Difference (mmHg) ||**	
RT *vs.* Control ‡	***k***	**d_+ (95% *CI*) *†**	***Q***	***p***	**I^2 (95% *CI*)**	***Mean* ± *SE***	**(95% *CI*)**
Stata 13.1	71	**-0.31 (-0.43, -0.19)**	143.4	<0.001	**51.2% (35.9, 62.9)**	**-3.03 ± 0.58**	**(-4.18, -1.88)**
R – metafor package	71	**-0.32 (-0.44, -0.20)**	141.4	<0.001	**50.5% (34.9, 62.4)**	**-3.46 ± 0.61**	**(-4.50, -2.07)**
1 RT group *vs.* Control	64	-0.33 (-0.45, -0.21)	140.5	<0.001	50.2% (34.4, 62.1)	-3.75 ± 0.71	(-5.33, -2.49)
2 RT groups *vs.* Control	7	-0.18 (-0.44, 0.07)				-1.27 ± 1.71	(-5.33, 3.06)

Diastolic BP:			**Homogeneity of *d*s §**			**BP Difference (mmHg) ||**	
RT *vs.* Control ‡	***k***	**d_+ (95% *CI*) *†**	***Q***	***p***	**I^2 (95% *CI*)**	***Mean* ± *SE***	**(95% *CI*)**
Stata 13.1	71	**-0.28 (-0.38, -0.18)**	107.6	0.003	**35.0% (12.9, 51.5)**	**-2.10 ± 0.34**	**(-2.78, -1.42)**
R – metafor package	71	**-0.28 (-0.38, -0.17)**	111.5	0.001	**37.2% (16.1, 53.0)**	**-2.33 ± 0.43**	**(-3.20, -1.50)**
1 RT group *vs.* Control	64	-0.29 (-0.40, -0.19)	107.7	0.002	35.0% (12.9, 51.5)	-2.57 ± 0.45	(-3.40, -1.59)
2 RT groups *vs.* Control	7	-0.07 (-0.36, 0.21)				-0.82 ± 1.27	(-4.18, 2.06)

Note. All analyses followed mixed-effects assumptions and models were fit using maximum-likelihood estimation. BP indicates blood pressure; *CI*, confidence interval; d_+, weighted mean effect size; *k*, number of observations in the model; RT, resistance training.

***** Negative values indicate that RT reduced BP to a greater extent compared to the control group.

† Comparisons were disaggregated for multi-treatment studies[2-8] (i.e., 2 different RT interventions were compared to a single control group); effect sizes (*d*s) were calculated for each comparison and analyzed as individual studies using Stata 13.1[9] (i.e., *d*s were considered *independent*). To determine whether dependence influenced our mean estimates, multivariate meta-analytic models that accounted for non-independent *d*s were generated in R[10] using the metafor package (*viz. rma.mv* function),[11,12] i.e., study identity was modelled as a random-effect allowing the model to fit the data/treatment effects nested within a study.

‡ Sensitivity analysis revealed similar estimates between models, see **bolded statistics**, indicating that non-independent *d*s did not influence our mean estimates.

§ Tests for homogeneity: The *Q* statistic (or Cochran's *Q*)[13] indicates whether significant heterogeneity is *present* (or not). The I^2 statistic[14,15] quantifies the amount of heterogeneity (i.e., the *degree* or *level* of inconsistency across results) that ranges from 0% to 100%; tentative cut-points for low, moderate, and high correspond to 25%, 50%, and 75%, respectively.

|| Represents the weighted mean BP change for the RT group relative to control.

Table S2. The blood pressure response to dynamic resistance training: A comparison of multiple moderator models generated using Stata 13.1 versus the metafor package in R.

Systolic BP (*k*=69) *	**Stata 13.1: Assumes *Independent* Effect Sizes**		**R – the metafor package: Controls for *Dependent* Effect Sizes**	
Moderator Dimension †	**d_+ (95% *CI*) ‡**	***p***	**d_+ (95% *CI*) ‡**	***p***
RT Sample: Resting SBP (mmHg)	-0.0154 (-0.0272, -0.0036)	0.011	-0.0186 (-0.0294, -0.0077)	0.0008
RT Sample: Race/Ethnicity	0.1778 (0.0690, 0.2867)	0.002	0.1886 (0.0903, 0.2869)	0.0002
RT Sample: BP Medication Use	0.1471 (0.0112, 0.2830)	0.034	0.1422 (0.0218, 0.2626)	0.0206
RT Exercises/Session	-0.0383 (-0.0753, -0.0013)	0.043	-0.0393 (-0.0743, -0.0043)	0.0279
BP Primary Study Outcome	-0.1197 (-0.2284, -0.0109)	0.032	-0.1139 (-0.2124, -0.0153)	0.0236
Not Shown in Table 3				
Resting SBP × RT Exercises	0.0024 (0.0006, 0.0065)	0.133	0.0036 (0.0006, 0.0065)	0.0168
Factor 1 (1 RT vs. Con: *k*=64)	NA	—		
Factor 2 (2 RT vs. Con: *k*=7)	NA	—		
§ Model Summary Multiple R^2 =	67.11% (57.77, 74.39)		92.16% (86.92,95.30)	
I^2 Residual =	27.25% (1.46, 46.31)		18.77% (0.00, 40.34)	
Diastolic BP (*k*=71) *	**d_+ (95% *CI*) ‡**	***p***	**d_+ (95% *CI*) ‡**	***p***
RT Sample: Resting DBP (mmHg)	-0.0167 (-0.0311, -0.0023)	0.011	-0.0168 (-0.0325, -0.0011)	0.0358
RT Sample: BP Medication Use	0.1285 (0.0140, 0.2431)	0.024	0.1204 (0.0167, 0.2242)	0.0229
RT Session Frequency (d/wk)	-0.1978 (-0.3649, -0.0307)	0.028	-0.2015 (-0.3589, -0.0441)	0.0121
Methodological Study Quality	0.0340 (0.0057, 0.0624)	0.019	0.0333 (0.0077, 0.0589)	0.0106
Not Shown in Table 4				
RT Sample: Race/Ethnicity	0.0425 (-0.0546, 0.1396)	0.385	0.0552 (-0.0366, 0.1471)	0.2387
Factor 1 (1 RT vs. Con: *k*=64)	NA	—	-0.2704 (-0.3759, -0.1649)	<0.0001
Factor 2 (2 RT vs. Con: *k*=7)	NA	—	-0.1234 (-0.4595, 0.2127)	0.4717
§ Model Summary Multiple R^2 =	49.85% (33.95, 61.90)		88.54% (79.74, 93.52)	
I^2 Residual =	19.62% (0.00, 40.70)		12.67% (0.00, 35.60)	

Note. BP indicates blood pressure; *CI*, confidence interval; DBP, diastolic BP; *k*, number of observations in the model; d_+, weighted mean effect size; RT, resistance training; SBP, systolic BP.

* Comparisons were disaggregated for multi-treatment studies[2-8] (i.e., 2 different RT interventions were compared to a single control group); effect sizes (*d*s) were calculated for each comparison and analyzed as individual studies using Stata 13.1[9] (i.e., *d*s were considered *independent*). To determine whether dependence influenced our model estimates, multivariate meta-analytic models that accounted for non-independent *d*s were generated in R[10] using the metafor package (*viz. rma.mv* function),[11,12] i.e., study identity was modelled as a random-effect allowing the model to fit the data/treatment effects nested within a study.

† Moderator variables were mean-centered in both models; all analyses followed mixed-effects assumptions and models were fit using maximum-likelihood estimation.

‡ Estimates the magnitude of DBP reduction among the RT group relative to control for each moderator, held constant at their mean, while statistically controlling for the presence of the moderators listed in the table above. Sensitivity analysis revealed similar estimates between models, indicating that non-independent *d*s did not significantly influence our multiple moderator meta-regression findings.

§ Model summary: Multiple R^2 (95% *CI*)=Variance explained by the model, adjusted for the number of moderators. I^2 Residual (95% *CI*)=Remaining variance that is unexplained by moderators (i.e., multiple moderator model). Missing model summary statistics for Stata 13.1 (i.e., 95% *CIs* for the Multiple R^2 and I^2 Residual) and the metafor package (i.e., statistics were converted to percentages) were estimated.[16]

Table S3: General description of each included study and a detailed summary of the baseline sample characteristics, dynamic resistance training and control interventions, and blood pressure outcomes (*k*=71).

Study Details *† and Baseline Sample Characteristics ‡§||	Features of the Dynamic RT and Con Interventions ¶ (***F***requency, ***I***ntensity, ***T***ime, ***T***ype and RT ***P***rogression)	BP Δ #	
		Post-Pre	***RT-Con***
Anton, 2006[17] RCT, US, funding=4)	**13 wk; *RT ─ Supervised, Placebo ─ Supervised × 2 d/wk + Unsupervised × 1 d/wk***		
RT = 13/13 (77% W), White, 52 yr, 26.7 kg/m^2, 112.0/65.0 mmHg	***F:*** 3 d/wk ***I:*** 75% 1-RM ***T:*** 1 set × 12 reps for 9 exercises (5 UB/ 3 LB/ 1 Core), 2 min rest b/w exercises ***T:*** Progressive, full-body RT ***P:*** 1-RM increased when ≥12 reps were completed.	0.0/ -2.0	**2.0/ -3.0**
Con = 13/13 (69% W), White, 53 yr, 26.2 kg/m^2, 120.0/65.0 mmHg	***F:*** 3 d/wk ***I:*** "low-intensity" ***T:*** ─ ***T***: Placebo control; stretching exercises that served to control for the possibility of random changes in key outcome variables and the attention the RT group would receive from the investigators	-2.0/ 1.0	
Arora, 2009[18] (RCT, India, funding=1)	**8 wk; *Supervised***		
RT = 10/9 (60% W), Asian, 50 yr, 27.0 kg/m^2, 126.0/82.0 mmHg, T2DM	***F:*** 2 d/wk ***I:*** 60-100% 1-RM ***T:*** 3 sets × 10 reps for 7 exercises (4 UB/2 LB/1 Core) ***T:*** Progressive, full-body RT ***P:*** RT was initially performed at 60% 1-RM, progressing to 100% 1-RM during 8 wk period.	-8.0/ -5.0	**-6.0/ -4.0**
Con = 10/10 (40% W), Asian, 58 yr, 25 kg/m^2, 131.0/84.0 mmHg, T2DM	Wait-list Control	-2.0/ -1.0	
Bateman, 2011[19] (X-RCT, US, funding=1)	**32 wk; *Supervised (directly) or monitored using FitLinxx Strength Training Partner***		
RT = 66/31 (48% W), *White (87%), Black (10%), Other (3%),* 51 yr, 30.8 kg/m^2, 120.0/78.8 mmHg, MetS	***F:*** 3 d/wk ***I:*** 8-12RM ***T:*** 45-60 min/d; 3 sets × 8-12 reps for 8-9 exercises (4 UB/ 4 LB/ 0-1 Core) ***T:*** Progressive, full-body RT ***P:*** All subjects completed 8-10 wk "Ramp period" prior to RT (i.e., gradually increase RT volume) (1) Wk 1-2: 1 set × 8-12 reps (2) Wk 3-4: 2 sets × 8-12 reps (3) Wk 5-32: 3 sets × 8-12 reps. RT load increased 2.3 kg (5 lb) when 3 sets × 12 reps were completed with proper form at 2 consecutive sessions.	2.3/ -0.2	**2.3/ -0.2**
Beck, 2013[20] (RCT, US, funding=1)	**8 wk**		
RT = 15/15 (27% W), White, 21 yr, 27.4 kg/m^2, 130.0/80.0 mmHg	***F:*** 3 d/wk ***I:*** 8-12RM ***T:*** ~60 min/d; 2 sets × 8-12 reps (to volitional fatigue) for 7 exercises (4 UB/ 3 LB), 2-3 min rest b/w sets and exercises ***T***: Progressive, full-body RT ***P***: Wk 1 (familiarization): 3 d/wk, 60% 1-RM to ensure proper lifting technique. RT load increased 5% when 2 sets × 12 reps were completed.	-9.0/ -8.0	**-9.0/ -8.0**
Con = 15/15 (33% W), White, 22 yr, 27 kg/m^2, 130.0/81.0 mmHg	Wait-list Con	0.0/ 0.0	
Blumenthal, 1991[21] (RCT, US, funding=3) †	**16 wk**		
RT = 35/31 (42% W), *White (76%)*, 46 yr, 27 kg/m^2, 143.0/95.0 mmHg, HTN	***F***: 2-3 d/wk ***I***: ─ ***T***: ~50 min/d ***T***: "flexibility training" (20 min) + full-body, circuit RT (30 min) ***P***: ─	-7.0/ -6.0	**2.0/ -1.0**
Con = 23/22 (32% W), *White (76%)*, 46 yr, 26.2 kg/m^2, 142.0/95.0 mmHg, HTN	Wait-list Con	-9.0/ -5.0	
Carter, 2003[22] (Non-RCT, US, funding=5) †	**8 wk; *Supervised***		
RT = 12/12 (8% W), White, 21 yr, 25.3 kg/m^2, 130.0/69.0 mmHg	***F***: 3 d/wk ***I***: 10RM ***T***: 45 min/d; 3 sets (2 sets × 10 reps + 1 set to failure) for 7 exercises (5 UB/ 2 LB), 2 min rest b/w exercises ***T***: Progressive, full-body isotonic RT ***P***: RT load increased when ≥10 reps were completed in set 3.	-9.0/ -8.0	**-10.0/ -6.0**
Con = 13/13 (15% W), White, 21 yr, 23.4 kg/m^2, 119.0/64.0 mmHg	Wait-list Con	1.0/ -2.0	
Casey, 2007[23] (RCT, US, funding=0)	**12 wk**		
RT = 30/24 (54% W), White, 21 yr, 23.3 kg/m^2, 117.6/73.9 mmHg	***F***: 3 d/wk ***I***: 8-12RM ***T***: 30-40 min/d; 2 sets × 8-12 reps (to volitional fatigue) for 7 exercises (4 UB/ 3 LB), 90 s rest b/w each set ***T***: Progressive, full-body RT ***P***: RT load increased ~5% when ≥12 reps were completed.	-0.7/ -2.6	**-1.9/ -2.1**
Con = 18/18 (56% W), White, 21 yr, 23.8 kg/m^2, 114.2/70.2 mmHg	Wait-list Con	1.2/ -0.5	

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*F*requency, *I*ntensity, *T*ime, *T*ype and RT *P*rogression)**	**BP Δ #**	
		Post-Pre	***RT-Con***
Castaneda, 2002[24] (RCT, US, funding=4) RT = 31/29 (68% W), *Caribbean (87%), Hispanic/ Latino (5%), "Other" (8%)*, 66 yr, 30.9 kg/m^2, 145.2/ 72.6 mmHg (83%), T2DM + HTN (83%) & CVD (55%) & dyslipidemia (48%)	**16 wk; *Supervised*** ***F*:** 3 d/wk ***I*:** 60-80% 1-RM ***T*:** 45 min/d (including 5 min of warm-up/cool down); 3 sets × 8 reps for 5 exercises (2 UB/ 3 LB) ***T*:** *Periodized,* full-body RT using pneumatic machines ***P*:** *Undulating model with 4 phases* (1) Wk 1-8: 60-80% 1-RM (2) Wk 9: RT load decreased ~10% (3) Wk 10-14: 70-80% 1-RM (4) Wk 15: RT load decreased ~10%. 1-RM values were re-evaluated mid-study and adjusted as needed.	-9.7/ -3.4	**-17.4/** **-3.1**
Con = 31/31 (61% W), *Caribbean (87%), Hispanic/ Latino (5%), "Other" (8%)*, 66 yr, 31.2 kg/m^2, 142.7/ 71.1 mmHg (79%), T2DM + HTN (79%) & CVD (64%) & dyslipidemia (38%)	Wait-list Con: Participants received weekly phone calls from researchers to assess adherence.	7.7/ -0.3	
Chaudhary, 2010[25] (Non-RCT, India, funding=0) † RT = 10/10 (100% W), Asian, 40 yr, 32.2 kg/m^2, 129.7/83.7 mmHg, obesity	**6 wk** ***F*:** 3 d/wk ***I*:** 50-100% of 10RM ***T*:** 4 sets × 10 reps for 7 exercises (2 UB/ 3 LB/ 2 Core) ***T*:** Progressive, full-body RT ***P*:** RT load increased in each set: set 1=50% of 10RM × 10 reps; set 2=75% of 10RM × 10 reps; sets 3 and 4=75-100% of 10RM × 10 reps (estimated using the Delorme and Watkins technique).	-3.0/ -0.2	**-3.6/** **-0.5**
Con = 10/10 (100% W), Asian, 40 yr, 31.8 kg/m^2, 125.8/84.8 mmHg, obesity	Wait-list Con	0.6/ 0.3	
Colado, 2009[2] (RCT, Spain, funding=1) † *Aquatic* RT = 22/15 (100% W), White, 55 yr, 27.6 kg/m^2, 132.7/84.7 mmHg	**24 wk; *Supervised*** ***F*:** 2-3 d/wk ***I*:** 5-7 RPE rating (OMNI-RT 0-10 scale) ***T*:** 35–60 min/d; 1-3 sets × 15-20 reps for 8-10 exercises (4-5 UB/ 4-5 LB + Core) ***T*:** Periodized, full-body aquatic circuit RT ***P*:** (1) Wk 1-4: 2 d/wk, 1-2 sets × 20 reps (2) Wk 5-12: 2 d/wk, 2 sets × 20 reps (3) Wk 9-12: 2 d/wk, 3 sets × 20 reps (4) Wk 13–18: 3 d/wk, 3 sets × 20 reps (5) Wk 19–24: 3 d/wk, 2 supersets × 30 reps (15 reps/set), 16 exercises (8 UB/ 8 LB), 30 s active rest b/w supersets.	-9.2/ -6.8	**-4.1/** **-7.6**
Theraband RT = 22/21 (100% W), White, 54 yr, 29.5 kg/m^2, 132.0/81.7 mmHg	***F*:** 2-3 d/wk ***I*:** 5-7 RPE rating (OMNI-RT 0-10 scale) ***T*:** 35–60 min/d; 1-3 sets × 15-20 reps for 8-10 exercises (4-5 UB/ 4-5 LB + Core) ***T*:** Periodized, full-body Therabands® circuit RT ***P* :** (1) Wk 1-4: 2 d/wk, 1-2 sets × 20 reps (2) Wk 5-12: 2 d/wk, 2 sets × 20 reps (3) Wk 9-12: 2 d/wk, 3 sets × 20 reps (4) Wk 13–18: 3 d/wk, 3 sets × 20 reps (5) Wk 19–24: 3 d/wk, 2 supersets × 30 reps (15 reps/set), 16 exercises (8 UB/ 8 LB), 30 s active rest b/w supersets.	-2.3/ -4.8	**2.8/** **-5.6**
Con = 11/10 (100% W), White, 53 yr, 27.5 kg/m^2, 138.0/80.2 mmHg	Wait-list Con	-5.1/ 0.8	
Concieção, 2013[26] (RCT, Brazil, funding=1) † RT = 10/10 (100% W), Hispanic/Latino, 53 yr, 26.2 kg/m^2, 138.4/89.8 mmHg, MetS	**16 wk** ***F*:** 3 d/wk ***I*:** 8-10RM ***T*:** 3 sets × 8-10 reps for 10 exercises (5 UB/ 3 LB/ 2 Core) ***T*:** Periodized, full-body RT ***P*:** *Linear (classic) model with 2 mesocycles* **(1)** Wk 0-8 (higher volume/lower intensity): 3 d/wk, 10RM, 3 sets × 10 reps, 10 exercises (5 UB/ 3 LB/ 2 Core), 60 s rest b/w sets **(2)** Wk 9-16 (lower volume/higher intensity): 3 d/wk, 8RM, 3 sets × 8 reps, 10 exercises (5 UB/ 3 LB/ 2 Core), 90 s rest b/w sets. RT load increased 0.5 and 1.0 kg/wk for UB and LB.	-7.6/ -1.6	**-9.1/** **-1.2**
Con = 10/10 (100% W), Hispanic/Latino, 53 yr, 25.3 kg/m^2, 111.8/78.4 mmHg, MetS	Wait-list Con	1.5/ -0.4	
Cononie, 1991[27] (Non-RCT, US, funding=1) † RT = 22/20 (45% W), White, 75 yr, –kg/m^2, 132.0/ 78.0 mmHg (15%)	**12 wk; *Supervised*** ***F*:** 3 d/wk ***I*:** 8-12RM ***T*:** ~30 min/d; 1 set × 8-12 reps for 10 exercises (6 UB/ 2 LB/ 2 Core), 1-2 min rest b/w exercises ***T*:** Progressive, full-body RT using Nautilus machines™ ***P*:** (1) Wk 0-13 (adaptation phase): 3 d/wk, "light-moderate", 1 set × 8-12 reps (2) Wk 14-26: 3 d/wk, 1 set × 8-12 reps (until volitional fatigue). RT load increased when 12 reps were completed. *Intervention details provided in Hagberg et al.*[28]	0.0/ 0.0	**-3.0/** **-2.0**
Con = 13/12 (67% W), White, 72 yr, –kg/m^2, 137.0/ 81.0 mmHg (8%)	Wait-list Con	3.0/ 2.0	

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*F*requency, *I*ntensity, *T*ime, *T*ype and RT *P*rogression)**	**BP Δ #**	
		Post-Pre	***RT-Con***
Cortez-Cooper, 2005[29] (Non-RCT, US, funding=4)	**11 wk; *Supervised***		
RT = 23/23 (100% W), White, 29 yr, 26.1 kg/m^2, 115.0/67.0 mmHg	***F***: 4 d/wk ***I***: 5-10RM ***T***: 3 sets × 5-10 reps for 12 exercises (8 UB/ 2 LB/ 2 Core) ***T***: Periodized, full-body RT with alternating light/heavy days ***P***: (1) Wk 0-4: 10RM, 3 sets × 10 reps (2) Wk 4-8: 5RM, 3 sets × 5 reps (3) Wk 8-11: 5RM, 6 timed supersets × 5 reps (i.e., alternating UB/LB; increasing load for 4 supersets, decreased for 2). RT load increased when 5 reps were completed in the final set of the heavy day.	0.0/ -2.0	**-2.0/ -5.0**
Con = 10/10 (100% W), White, 27 yr, 25.8 kg/m^2, 109.0/64.0 mmHg	Wait-list Con	2.3/ 2.1	
Cortez-Cooper, 2008[30] (RCT, US, funding=4)	**13 wk; *RT ─ Supervised, Placebo ─ Supervised × 2 d/wk + Unsupervised × 1 d/wk***		
RT = 14/13 (77% W), White, 51 yr, 26.8 kg/m^2, 113.0/66.0 mmHg	***F***: 3 d/wk ***I***: 70% 1-RM ***T***: 30-45 min/d; 3 sets × 8-12 reps for 10 exercises (5 UB/ 3 LB/ 2 Core), 2-3 min rest b/w exercises ***T***: Progressive, full-body RT ***P***: RT load increased when ≥12 reps were completed.	0.0/ 2.0	**3.0/ 1.0**
Con = 13/12 (67% W), White, 54 yr, 25.7 kg/m^2, 122.0/66.0 mmHg	***F***: 3 d/wk ***I***: mild (i.e., point of minimal discomfort) ***T***: 30-45 min/d; 3 sets × 20 s per stretch ***T***: Placebo Con; full-body static stretching program, designed by a physical therapist, that targeted the major muscle groups.	-3.0/ 1.0	
Croymans, 2014[31] (RCT, US, funding=4) †	**12 wk; *Supervised (small groups ─ 3:1)***		
RT = 28/28 (100% M), White, 22 yr, 30.9 kg/m^2, 132.0/81.0 mmHg, obesity	***F***: 3 d/wk ***I***: 12–15RM/ 8-12RM/ 6–8RM ***T***: 60 min/d; 2-3 sets × 6-15 reps for protocols: 7-8 exercises (4-5 UB/ 2-3 LB/ 0-1 Core), 60-90 s rest b/w supersets ***T***: Periodized, full-body RT ***P***: *Linear (classic) model with 3 phases* (1) Wk 1-2: 100% of 12-15RM, 2 sets × 12-15 reps (until volitional fatigue) (2) Wk 3-7: 100% of 8-12RM, 3 sets × 8-12 reps (3) Wk 8-12: 100% of 6-8RM, 3 sets × 6-8 reps. RT load increased for each phase (as needed).	-8.5/ -5.5	**-5.0/ 5.0**
Con = 8/8 (100% M), White, 22 yr, 33.6 kg/m^2, 131.0/84.5 mmHg, obesity	Wait-list Con	-3.5/ -10.5	
Elliot, 2002[32] (RCT, UK, funding=0)	**8 wk**		
RT = 8/8 (100% W), White, 58 yr, 26.9 kg/m^2, 133.0/72.0 mmHg	***F***: 3 d/wk ***I***: 80% 10RM ***T***: 3 sets × 8 reps for 5 exercises (2 UB/ 3 LB), 2 min rest b/w sets ***T***: Full-body RT ***P***: 10RM was re-evaluated after 4 wk, and RT loads adjusted.	-15.0/ -6.0	**-14.0/ -9.0**
Con = 7/7 (100% W), White, 53 yr, 24.0 kg/m^2, 133.0/75.0 mmHg	Wait-list Con	-1.0/ 3.0	
Gelecek, 2012[33] (RCT, Turkey, funding=1) †	**12 wk; *Supervised***		
RT = 26/24 (100% W), White, 54 yr, 28 kg/m^2, 111.9/70.0 mmHg	***F***: 3 d/wk ***I***: 60% 1-RM ***T***: 2 sets × 8-12 reps for 10 exercises, 30-60 s rest b/w sets and exercises ***T***: Progressive, full-body RT ***P***: 1-RM was re-evaluated at the start of each 2 wk period; every 2 wk 1-RM and the number of reps increased (8/10/12).	-3.8/ 0.2	**-11.2/ -1.2**
Con = 25/19 (100% W), White, 52 yr, 27.2 kg/m^2, 112.6/72.4 mmHg	Wait-list Con	0.5/ 1.4	
Gerage, 2013[34] (RCT, Brazil, funding=3) †	**12 wk; *Supervised (one-on-one)***		
RT = 17/15 (100% W), Hispanic/Latino, 66 yr, 23.9 kg/m^2, 125.0/81.0 mmHg	***F***: 3 d/wk ***I***: 10-15RM ***T***: 2 sets × 10-15 reps for 8 exercises (4 UB/ 3 LB/ 1 Core), 60-90 s and 2-3 min rest b/w sets and exercises ***T***: Progressive, full-body RT ***P***: Subjects underwent 6 familiarization sessions prior to RT; RT load increased 2-5% and 5-10% for UB and LB when ≥15 reps were completed in 2 consecutive sets.	-5.0/ -1.0	**-8.0/ -3.0**
Con = 14/14 (100% W), Hispanic/Latino, 66 yr, 25.1 kg/m^2, 123.0/80.0 mmHg	***F***: 2 d/wk (non-consecutive days) ***I***: maximal stretched position ***T***: 25-30 min/d; 2 reps × 20 s per exercise, 15-30 s rest b/w exercises ***T***: Placebo Con; full-body static stretching exercises that followed recommendations from the American College of Sports Medicine ***P***: ─	3.0/ 2.0	
Gurjão, 2013[35] (RCT, Brazil, funding=0) †	**8 wk; *Supervised***		
RT = 11/10 (100% W), Hispanic/Latino, 62 yr, 25.0 kg/m^2, 130.6/86.2 mmHg	***F***: 3 d/wk ***I***: 10-12RM ***T***: 3 sets × 10-12 reps for 7 exercises (4 UB/ 2 LB/ 1 Core), 90 s rest b/w sets and exercises ***T***: Progressive, full-body RT ***P***: RT load increased 2-10% when >12 reps were completed in sets 2 and 3.	-13.2/ -11.0	**-18.6/ -7.8**

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*Frequency*, *Intensity*, *Time*, *Type* and RT *Progression*)**	**BP Δ #**	
		Post-Pre	***RT-Con***
Con = 10/7 (100% W), Hispanic/Latino, 65 yr, 26.1 kg/m^2, 120.6/74.6 mmHg	Wait-list Con	6.6/-3.2	
Harris, 1987[36] (RCT, US, funding=0) †	**9 wk**		
RT = 10/10 (100% M), White, 33 yr, 26.3 kg/m^2, 141.7/95.8 mmHg, HTN	***F***: 3 d/wk ***I***: 40% 1-RM ***T***: 3 sets × 20-25 reps for 10 exercises (5 UB/ 4 LB/ 1 Core), each station used a 45:15 s work-to-rest ratio ***T***: Progressive, full-body circuit RT ***P***: RT load increased when 25 reps were completed.	0.6/-4.5	**0.9/-2.5**
Con = 16/16 (100% M), White, 31 yr, 25.3 kg/m^2, 146.1/94.6 mmHg, HTN	Wait-list Con	-0.3/-2.0	
Ho, 2012[37] (RCT, Australia, funding=2) †	**12 wk**		
RT = 22/16 (–% W), White, 52 yr, 33 kg/m^2, 125.0/71.0 mmHg (13%), obesity	***F***: 5 d/wk ***I***: 10RM (~75% 1-RM) ***T***: 30 min/d; 4 sets × 8-12 reps for 5 exercises (2 UB/ 3 LB), 1 min rest b/w sets ***T***: Progressive, full-body RT ***P***: (1) Wk 0-2: 3 d/wk, 8-10RM (2) Wk 3-12: 5 d/wk, 8-10RM. RT load increased 2.5 kg when >12 reps were completed. *Intervention details provided in Ho et al.*[38]	-1.7/-1.0	**2.3/1.2**
Con = 19/16 (–% W), White, 52 yr, 32 kg/m^2, 120.1/65.4 mmHg (6%), obesity	***F***: 7 d/wk ***I***: – ***T***: – ***T***: Placebo Con; Dietary supplement taken once daily; supplement contained approximately 2 g of breadcrumbs and 0.1 g of Equal artificial sweetener)	-4.0/-2.2	
Hu, 2009[39] (RCT, Finland, funding=4)	**10 wk; *Supervised***		
RT = 52/48 (100% M), White, 32 yr, 25.2 kg/m^2, 140.0/79.0 mmHg, HTN	***F***: 2-3 d/wk ***I***: 'typical' heavy RT + explosive RT ***T***: 30-40 min/d ***T***: Progressive RT using free weights and machines (e.g., pneumatic, weight stack) ***P***: RT load was re-evaluated mid-study (wk 5) and adjusted as needed. *Intervention details provided in Hu et al.*[40]	-5.0/-4.0	**0.0/1.0**
Con = 22/21 (100% M), White, 31 yr, 24.6 kg/m^2, 137.0/78.0 mmHg	Wait-list Con	-5.0/-5.0	
Jakovljevic, 2013[41] (RCT, UK, funding=3) †	**8 wk; *Supervised (bi-weekly)***		
RT = 9/9 (22% W), White, 49 yr, 33 kg/m^2, 129.0/87.0 mmHg, NAFLD	***F***: 3 d/wk ***I***: 50%-70% 1-RM ***T***: 45-60 min/d; 2-3 sets for 8 exercises (5 UB/ 3 LB) ***T***: Progressive, full-body circuit RT ***P***: (1) Wk 1-6: 50-70% 1-RM, 2 sets for 8 exercises (2) Wk 7-8: 70% 1-RM, 3 sets for 8 exercises. RT load increased weekly (as tolerated). *Biweekly supervision* – Encouraged adherence and progression; exercise logs and heart rate recordings (Polar monitor) were used to assess adherence.	4.0/-1.0	**0.0/-5.0**
Con = 8/8 (38% W), White, 62 yr, 33 kg/m^2, 132.0/85.0 mmHg, NAFLD	Wait-list Con	4.0/4.0	
Jorge, 2011[42] (RCT, Brazil, funding=1)	**12 wk; *Supervised***		
RT = 12/12 (58% W), Hispanic/Latino, 54 yr, 31.3 kg/m^2, 135.0/83.8 mmHg (67%), T2DM + HTN (67%) & dyslipidemia (25%)	***F***: 3 d/wk ***I***: – ***T***: 60 min/d; 7 exercises (4 UB/ 2 LB/ 1 Core) ***T***: Full-body RT ***P***: –	-10.0/-2.5	**1.7/4.2**
Con = 12/12 (67% W), Hispanic/Latino, 53 yr, 30.0 kg/m^2, 135.8/85.0 mmHg (33%), T2DM + HTN (33%) & dyslipidemia (8%)	***F***: 3 d/wk ***I***: "light" intensity ***T***: – ***T***: Placebo Con; stretching exercises designed to provide participative involvement but not to elicit changes in muscle strength or cardiovascular fitness ***P***: –	-11.7/-6.7	
Kanegusuku, 2011[3] (RCT, Brazil, funding=4) †	**16 wk; *Supervised***		
Power RT = 15/15 (62% W), Hispanic/Latino, 65 yr, 26.5 kg/m^2, 125.0/75.0 mmHg, T2DM (20%) & dyslipidemia (7%)	***F***: 2 d/wk ***I***: 30-50% 1-RM ***T***: 3-4 sets × 4-7 reps for 7 exercises (2 UB/ 5 LB), ≥3 min rest b/w sets and exercises ***T***: Periodized, full-body RT using soinertial machines ***P***: (1) Wk 1-2: 30% 1-RM, 3 sets × 7 reps (2) Wk 3-4: 35% 1-RM, 3 sets × 7 reps (3) Wk 5-8: 30/40% 1-RM, 3/1 set(s) × 7/6 reps (4) Wk 9-12: 40% 1-RM, 4 sets × 6 reps (5) Wk 13-14: 40/45% 1-RM, 2/2 sets × 6/4 reps (6) Wk 15-16: 45/50% 1-RM, 2/2 sets × 6/4 reps.	-8.0/-2.0	**1.0/2.0**
Strength RT = 13/13 (62% W), Hispanic/Latino, 63 yr, 27.4 kg/m^2, 121.0/78.0 mmHg, T2DM (23%)	***F***: 2 d/wk ***I***: 70-90% 1-RM ***T***: 2-4 sets × 4-10 reps for 7 exercises (2 UB/ 5 LB), ≥3 min rest b/w sets and exercises ***T***: Periodized, full-body RT using soinertial machines ***P***: (1) Wk 1-2: 70% 1-RM, 2 sets × 10 reps (2) Wk 3-4: 75% 1-RM, 2	-5.0/-3.0	**4.0/1.0**

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*Frequency*, *Intensity*, *Time*, *Type* and RT *Progression*)**	**BP Δ #**	
		Post-Pre	***RT-Con***
	sets × 10 reps (3) Wk 5-8: 75/80% 1-RM, 2/1 set(s) ×10/8 reps (4) Wk 9-12: 80% 1-RM, 3 sets × 8 reps (5) Wk 13-14: 80/85% 1-RM, 2/2 sets × 8/6 reps (6) Wk 15-16: 85/90% 1-RM, 2/2 sets × 6/4 reps.		
Con = 11/11 (82% W), Hispanic/Latino, 63 yr, 27.3 kg/m^2, 127.0/77.0 mmHg, dyslipidemia (18%)	Wait-list Con	-9.0/-4.0	
Katz, 1992[43] (RCT, US, funding=0) † RT = 13/13 (100% W), *White (100%)*, 22 yr, –kg/m^2, 107.5/65.3 mmHg	**6 wk** ***F***: 3 d/wk ***I***: 30% 1-RM ***T***: ~30 min/d; 1 set × 11-15 reps for 13 exercises (11-12 reps × 7 UB, 14-15 reps × 5 LB/ 2 Core), active rest b/w exercises ***T***: Progressive, full-body circuit RT ***P***: RT load increased 5% as needed.	-8.4/-4.1	**-7.1/-5.1**
Con = 13/8 (100% W), *White (100%)*, 19 yr, –kg/m^2, 113.8/67.2 mmHg	Wait-list Con: Participants attended the laboratory 3 d/wk to have resting BP assessed.	-1.3/1.0	
Kawano, 2006[44] (RCT, Japan, funding=3) *Mod* RT = 12/12 (100% M), Asian, 20 yr, 23 kg/m^2, 120.0/71.0 mmHg	**16 wk; *Supervised*** ***F***: 3 d/wk ***I***: 50% 1-RM ***T***: 45 min/d; 3 sets × 14-16 reps for 6 exercises (2 UB/ 3 LB/ 1 Core), 2 min rest b/w exercises ***T***: Full-body RT ***P***: –	-3.0/-5.0	**-4.0/-10.0**
Con = 16/16 (100% M), Asian, 22 yr, 22 kg/m^2, 118.0/68.0 mmHg	Wait-list Con	1.0/5.0	
Locks, 2012[45] (RCT, Brazil, funding=0) RT = 21/13 (56% W), *Hispanic/Latino (100%)*, 69 yr, –kg/m^2, 141.0/81.0 mmHg, HTN	**12 wk; *Supervised*** ***F***: 2 d/wk ***I***: 65-75% 10RM ***T***: 3 sets × 8 reps for 7 exercises (0 UB/ 7 LB) ***T***: Progressive, full-body RT ***P***: Wk 0-5: 65% 10RM. Wk 5-9: 70% 10RM. Wk 9-12: 75% 10RM.	-4.0/4.0	**-12.0/2.0**
Con = 35/13 (56% W), *Hispanic/Latino (100%)*, 66 yr, –kg/m^2, 132.0/80.0 mmHg	***F***: 2 d/wk ***I***: maximal tension ***T***: 4 sets × 1 min, with 1 min of rest/relaxation b/w reps ***T***: Placebo Con; active static stretching using both limbs ***P***: –	8.0/2.0	
Lovell, 2009[46] (RCT, Australia, funding=0) RT = 12/12 (100% M), White, 74 yr, 25.1 kg/m^2, 135.0/84.0 mmHg	**16 wk; *Supervised (one-on-one)*** ***F***: 3 d/wk ***I***: 70-90% 1-RM ***T***: 3 sets × 6-10 reps for 1 LB exercise, 2 min rest b/w sets ***T***: Incline squat machine ***P***: Prior to RT, subjects had 2 wk familiarization period: 50% 1-RM, 3 sets × 8 reps. RT load increased as needed.	2.0/-2.0	**0.0/1.0**
Con = 12/12 (100% M), White, 74 yr, 25.2 kg/m^2, 137.0/82.0 mmHg	Wait-list Con	2.0/-3.0	
Marioana, 2011[47] (RCT, Australia, funding=3) RT = 14/12 (17% W), White, 59 yr, 28.4 kg/m^2, 125.0/71.0 mmHg, heart failure/CVD	**12 wk; *Supervised*** ***F***: 3 d/wk ***I***: 50-70% 1-RM ***T***: 46.5 min/d; 3 sets × 45-60: 30-45 s (work:rest ratio) for 9 exercises, 3 min rest b/w sets ***T***: Interval, full-body circuit RT ***P***: Wk 0-6: 50-60% 1-RM, 2:1 (60:30 s). Wk 6-12: 60-70% 1-RM, 1:1 (45:45 s).	-2.0/-2.0	**0.0/0.0**
Con = 12/12 (8% W), White, 64 yr, 30.1 kg/m^2, 123.0/69.0 mmHg, heart failure/CVD	Wait-list Con	-2.0/-2.0	
Miyachi, 2004[48] (RCT, Japan, funding=4) RT = 14/14 (100% M), Asian, 22 yr, 22.2 kg/m^2, 116.0/69.0 mmHg	**16 wk; *Supervised*** ***F***: 3 d/wk ***I***: 80% 1-RM ***T***: 45 min/d; 3 sets × 8-12 reps, 2 min rest b/w exercises ***T***: 6 exercises (2 UB/ 3 LB/ 1 Core) ***P***: Sets 1 and 2: 12 reps; Set 3: Until concentric failure. RT load increased when ≥10 reps were completed in set 3.	0.0/-3.0	**-2.0/-6.0**
Con = 14/14 (100% M), Asian, 22 yr, 22.9 kg/m^2, 118.0/69.0 mmHg	Wait-list Con	2.0/3.0	
Mota, 2013[49] (Non-RCT, Brazil, funding=0) † RT = 32/32 (100% W), Hispanic/Latino, 68 yr, 27.8 kg/m^2, 134.5/76.0 mmHg (100%), HTN	**16 wk** ***F***: 3 d/wk ***I***: 60-80% 1-RM ***T***: ~40 min/d; 3 sets × 8-12 reps for 10 exercises (3 UB/ 5 LB/ 2 Core) ***T***: Periodized, full-body RT ***P***: (1) 12 sessions, "light intensity", 3 sets × 10 reps, 30 s rest b/w sets (2) 16 sessions, 60% 1-RM, 3 sets × 12 reps, 60 s rest b/w sets (3) 16 sessions, 70% 1-RM, 3 sets × 10 reps, 60 s rest b/w sets (4) 16 sessions, 80% 1-RM, 3 sets × 8 reps, 90 s rest b/w sets.	-14.3/-3.6	**-14.8/-3.1**

Study Details *† and Baseline Sample Characteristics ‡§‖	Features of the Dynamic RT and Con Interventions ¶ (**_F_**requency, **_I_**ntensity, **_T_**ime, **_T_**ype and RT **_P_**rogression)	BP Δ #	
		Post-Pre	***RT-Con***
Con = 32/32 (100% W), Hispanic/Latino, 67 yr, 29.4 kg/m^2, 131.8/74.3 mmHg (100%), HTN	Wait-list Con	0.5/ -0.5	
Norris, 1990[50] (Non-RCT, UK, funding=0) †	**10 wk; *Supervised × 2-3 d/wk + Unsupervised × 0-1 d/wk***		
RT = 50/24 (100% M), White, –yr, –kg/m^2, 148.0/92.0 mmHg, HTN	**_F_:** 3 d/wk **_I_:** – **_T_:** 20-30 min/d; 7 exercises (4 UB/ 3 LB) **_T_:** Full-body RT **_P_:** – Subjects were required to attend 2 out of 3 weekly classes; could "make up" missed sessions on their own (instructors kept attendance records).	-13.8/ -7.7	**-14.8/ -9.4**
Con = 50/25 (100% M), White, –yr, –kg/m^2, 135.4/86.9 mmHg	Wait-list Con: Participants were unaware of the other groups (i.e., RT and aerobic exercise interventions).	1.0/ 1.7	
Nybo, 2010[51] (Non-RCT, Denmark, funding=1) †	**12 wk**		
Heavy RT = 8/8 (100% M), White, 36 yr, –kg/m^2, 129.0/82.0 mmHg	**_F_:** 2-3 d/wk **_I_:** 6-16RM **_T_:** ~60 min/d; 3-4 sets × 6-16 reps for 6 exercises, 1 min rest b/w sets **_T_:** Progressive, LB-RT **_P_:** (1) Wk 0-4: 12-16RM, 3-4 sets × 12-16 reps (2) Wk 5-12: 6-10RM, 3-4 sets × 6-10 reps.	-8.0/ -7.0	**-6.0/ -9.0**
Con = 11/11 (100% M), White, 30 yr, –kg/m^2, 129.0/74.0 mmHg	Wait-list Con	-2.0/ 2.0	
Okamoto, 2006[4] (RCT, Japan, funding=0)	**8 wk; *Supervised***		
Concentric RT = 10/10 (100% W), Asian, 19 yr, 21.9 kg/m^2, 101.6/60.4 mmHg	**_F_:** 3 d/wk **_I_:** 80% 1-RM **_T_:** 5 sets × 10 reps for 1 UB exercise **_T_:** Concentric RT, unilateral bicep curl (non-dominant arm used to minimize the effects on daily life) **_P_:** 1-RM was re-evaluated after 4 wk and adjusted as needed.	1.2/ 0.3	**3.6/ 1.7**
Eccentric RT = 10/10 (100% W), Asian, 19 yr, 21.7 kg/m^2, 104.7/61.3 mmHg	**_F_:** 3 d/wk **_I_:** 100% 1-RM **_T_:** 5 sets × 10 reps for 1 UB exercise **_T_:** Eccentric RT, unilateral bicep curl (non-dominant arm used to minimize the effects on daily life) **_P_:** 1-RM was re-evaluated after 4 wk and adjusted as needed.	-2.1/ -1.3	**0.3/ 0.1**
Con = 9/9 (100% W), Asian, 20 yr, 20.4 kg/m^2, 105.0/58.4 mmHg	Wait-list Con	-2.4/ -1.4	
Okamoto, 2011[52] (RCT, Japan, funding=1)	**10 wk**		
Low-load RT = 13/13 (23% W), Asian, 19 yr, 23.3 kg/m^2, 115.0/64.0 mmHg	**_F_:** 3 d/wk **_I_:** 50% 1-RM **_T_:** 5 sets × 10 reps for 8 exercises (4 UB/ 3 LB/ 1 Core), 30 s rest b/w sets (i.e., short inter-set rest periods) **_T_:** Low-intensity, full-body RT **_P_:** –	1.0/ 0.0	**3.0/ 1.0**
Con = 13/13 (31% W), Asian, 19 yr, 22.9 kg/m^2, 116.0/62.0 mmHg	Wait-list Con	-2.0/ -1.0	
Oliviera, 2012[53] (RCT, Brazil, funding=1)	**12 wk; *Supervised***		
RT = 12/10 (60% W), Hispanic/Latino, 54 yr, 31.3 kg/m^2, 135.0/83.7 mmHg (80%), T2DM + HTN & dyslipidemia (30%)	**_F_:** 3 d/wk **_I_:** 50% 1-RM to 8-12RM (until volitional fatigue) **_T_:** 60 min/d; 2-4 sets × 8-15 reps for 7 exercises (4 UB/ 2 LB/ 1 Core), 2 min rest b/w circuit laps **_T_:** Progressive, circuit RT **_P_:** (1) Wk 1: 50% 1-RM, 2 sets × 10-15 reps (2) Wk 2: 50% 1-RM, 4 sets × 10-15 reps (3) Wk 3-12: 8-12RM, 4 sets × 8-15 reps. RT load was increased as needed	-10.0/ -2.5	**1.6/ 4.2**
Con = 12/12 (67% W), Hispanic/Latino, 53 yr, 30.0 kg/m^2, 135.8/85.0 mmHg (33%), T2DM + HTN & dyslipidemia (8%)	**_F_:** 3 d/wk **_I_:** "light" **_T_:** 60 min/d or 180 min/wk **_T_:** Placebo Con; full-body stretching designed to poorly stimulate heart rate and other physiological actions known to favorably affect health outcomes (i.e, glycemic control, blood glucose self-monitoring, medication compliance) **_P_:** –	-11.6/ -6.7	
Olson, 2007[54] (RCT, US, funding=3)	**48 wk; *Supervised + Unsupervised***		
RT = 16/16 (100% W), White, 39 yr, 26.9 kg/m^2, 118.0/69.0 mmHg	**_F_:** 2 d/wk **_I_:** 8-10RM **_T_:** 3 sets × 9 reps for 10 exercises (6 UB/ 4 LB) **_T_:** Progressive, full-body isotonic RT **_P_:** RT load increased by the smallest absolute increment when 10 reps were completed for sets 1-2, and 12 reps for set 3, in 2 consecutive sessions. *Supervision* – Wk 0-16: Supervised by a certified fitness trainer (5:1, small groups); Wk 17-48: *Unsupervised* (participants maintained activity logs and met with fitness trainer × 2 d every 12 wk).	-13.0/ -9.0	**-6.0/ -7.0**
Con = 16/12 (100% W), White, 38 yr, 27 kg/m^2, 121.0/69.0 mmHg	Wait-list Con: For ethical consideration, Con participants were offered "Walking for a Healthy Heart – Our Guide to Help You Start a Regular Walking Program" and "Exercise and Your Heart – A Guide to Physical Activity' brochures from the American Heart Association" without further instruction.	-7.0/ -2.0	

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (Frequency, Intensity, Time, Type and RT Progression)**	**BP Δ #**	
		Post-Pre	***RT-Con***
Park, 2011[55] (RCT, Korea, funding=1) †	**12 wk; *Supervised (small groups)***		
Theraband RT = 22/18 (68% W), Asian, 71 yr, –kg/m^2, 134.6/77.9 mmHg (89%), HTN + "other health conditions" (52%)	***F***: 2 d/wk ***I***: "light" (red color band) ***T***: 40 min/d; 2-3 sets × 15-25 reps for 12-15 exercises (10 UB/ 3 LB/ 3 Core) ***T***: Full-body RT using Therabands® ***P***: –	-12.3/ -0.9	**-15.1/ 4.3**
Con = 23/22 (68% W), Asian, 70 yr, –kg/m^2, 130.3/84.3 mmHg (86%), HTN + "other health conditions" (37%)	***F***: 1 d/wk ***I***: – ***T***: – ***T***: Placebo Con; Attended weekly health education lectures delivered by trained nurses ***P***: Wk 4-12: Trained nurses provided 30 min of individual health counseling, in addition to weekly lectures, to help initiate and maintain self-management behaviors and identify potential problems in the program.	2.8/ -5.2	
Reis, 2012[56] (RCT, Brazil, funding=3)	**12 wk**		
RT = 27/27 (100% W), *Hispanic/ Latino (100%),* 53 yr, 28.6 kg/m^2, 119.6/80.9 mmHg	***F***: 2 d/wk ***I***: 60-85% 1-RM ***T***: 60 min/d; 2-3 sets × 6-15 reps for 6 exercises ***T***: Progressive, LB RT ***P***: (1) Wk 1: 60% 1-RM, 2 sets × 10-15 reps (2) Wk 2-3: 70-80% 1-RM, 3 sets × 8-10 reps (3) Wk 4-12: 85% 1-RM, 2 sets × 6 reps	0.0/ -1.7	**1.4/ -0.3**
Con = 31/24 (100% W), *Hispanic/Latino (100%),* 54 yr, 30.1 kg/m^2, 124.3/81.4 mmHg	Wait-list Con	-1.4/ -1.4	
Sallinen, 2007[57] (RCT, Finland, funding=0) †	**21 wk; *Supervised***		
RT = 22/20 (100% M), White, 58 yr, 24.5 kg/m^2, 130.1/82.4 mmHg (14%)	***F***: 2 d/wk ***I***: 40-80% 1-RM ***T***: 3-6 sets × 5-20 reps for 6-8 exercises (of 14 options: 5 UB/ 6 LB/ 3 Core) ***T***: Periodized, full-body RT ***P***: *Low-volume model* (1) Wk 1-4: 40-60% 1-RM, 3 sets × 10-20 reps (2) Wk 5-7: 50-70% 1-RM, 3-4 sets × 8-15 reps (3) Wk 8-11: 40-50% 1-RM/60-70% 1-RM, 3-4 sets × 12-20/8-12 reps (4) Wk 12-13: 50%/ 60-70%/ 70-80%, 4-5 sets × 12-15/8-12/5-8 rep (5) Wk 14-18: 60%/70%/80% 1-RM, 5-6 sets × 10-12/8-10/5-8 reps (6) Wk 19-21: 60-70%/70-80%, 4-5 sets × 8-12/5-10 reps. 1-RM values were re-evaluated periodically. *Intervention details provided in Häkkinen et al.*[58]	-6.3/ -3.9	**-0.3/ -0.2**
Con = 21/19 (100% M), White, 58 yr, 25.4 kg/m^2, 131.3/82.8 mmHg (14%)	Wait-list Con	1.6/ -1.3	
Sarsan, 2006[59] (RCT, Turkey, funding=0)	**12 wk; *Supervised***		
RT = 26/20 (100% W), White, 43 yr, 33.7 kg/m^2, 126.5/79.5 mmHg, obesity	***F***: 3 d/wk ***I***: 40-80% 1-RM ***T***: 1-3 sets × 10 reps for 6 exercises (2 UB/ 2 LB/ 2 Core), 15-30 s rest b/w sets ***T***: Progressive, full-body RT ***P***: (1) Wk 1: 40-60% 1-RM, 1 set × 10 reps (2) Wk 2: 40-60% 1-RM, 2 sets × 10 reps (3) Wk 3: 40-60% 1-RM, 3 sets × 10 reps (4) Wk 4-5: 75-80% 1-RM, 3 sets × 10 reps.	-9.5/ -6.5	**-10.0/ -5.8**
Con = 24/20 (100% W), White, 44 yr, 35.5 kg/m^2, 126.5/77.8 mmHg, obesity	Wait-list Con	0.5/ -0.8	
Shaw, 2010[60] (Non-RCT, Gauteng, funding=0) †	**8 wk; *Supervised***		
RT = 13/13 (100% M), Black, 28 yr, 24.4 kg/m^2, 125.4/86.2 mmHg	***F***: 3 d/wk ***I***: 60% 1-RM ***T***: 3 sets × 15 reps for 9 exercises (7 UB/ 1 LB/ 1 Core) ***T***: Progressive, full-body RT ***P***: 1-RM was re-evaluated after 4 wk and adjusted accordingly.	-14.9/ -6.6	**-14.9/ -6.9**
Con = 15/15 (100% M), Black, 28 yr, 26.6 kg/m^2, 123.5/82.2 mmHg	Wait-list Con	0.0/ 0.3	
Sheikholeslami, 2011[5] (RCT, Iran, funding=0) †	**6 wk**		
Heavy-load RT = 10/10 (100% M), Asian, 20 yr, 21.8 kg/m^2, 124.0/86.7 mmHg	***F***: 3 d/wk ***I***: 80-90% 1-RM ***T***: 3 sets × 4-6 reps for 6 exercises (3 UB/ 3 LB), 1-2 min rest b/w sets and 3 min b/w exercises ***T***: Full-body RT ***P***: –	-3.3/ -2.0	**-5.3/ -3.0**
Moderate-load RT = 10/10 (100% M), Asian, 21 yr, 22.1 kg/m^2, 119.0/87.0 mmHg	***F***: 3 d/wk ***I***: 45-55% 1-RM ***T***: 3 sets × 10-12 reps for 6 exercises (3 UB/ 3 LB), 1-2 min rest b/w sets and 3 min b/w exercises ***T***: Full-body RT ***P***: –	-1.0/ -3.2	**-3.0/ -4.2**
Con = 10/10 (100% M), Asian, 21 yr, 22.1 kg/m^2, 123.0/87.3 mmHg	Wait-list Con	2.0/ 1.0	

Study Details *† and Baseline Sample Characteristics ‡§||	Features of the Dynamic RT and Con Interventions ¶ (***F***requency, ***I***ntensity, ***T***ime, ***T***ype and RT ***P***rogression)	BP Δ #	
		Post-Pre	***RT-Con***
Sheikholeslami, 2012[61] (RCT, Iran, funding=0) † RT = 10/10 (100% M), Asian, 21 yr, 27.2 kg/m^2, 120.0/84.0 mmHg	**6 wk** ***F***: 3 d/wk (1 d/wk × muscle groups) ***I***: 60-70% 1-RM ***T***: 4-5 sets × 6-12 reps for chest & triceps (7 exercises)/ back & biceps (7 exercises)/ leg, shoulder, core (4/4/1 exercises), 60-120 s rest b/w sets ***T***: Progressive, Full-body RT using muscle grouping ***P***: (1) Wk 1/2: 4 sets × 10-12/8-10 reps, 60/90 s rest b/w sets. (2) Wk 3/4: 5/4 sets × 6-8/8-10 reps, 120 s rest b/w sets (3) Wk 5/6: 4 sets × 10-12 reps, 90/60 s rest b/w sets.	-0.3/ -3.0	**0.6/** **-1.0**
Con = 10/9 (100% M), Asian, 21 yr, 26.9 kg/m^2, 121.6/84.0 mmHg	Wait-list Con	-0.9/ -2.0	
Sigal, 2007[62] (RCT, Canada, funding=8) RT = 64/57 (38% W), *White (91%), Other (9%),* 55 yr, 34 kg/m^2, 136.0/80.0 mmHg (56%), T2DM + obesity & HTN (56%) & dyslipidemia (41%)	**26 wk; *Supervised + Unsupervised*** ***F***: 3 d/wk ***I***: 8-12RM ***T***: 2-3 sets × 8-12 reps for 7 exercises (4 UB/ 2 LB/ 1 Core) ***T***: Progressive, full-body RT ***P***: All subjects completed 'Run-in Phase' prior to randomization (1) Wk 0-4 (run-in phase): aerobic exercise 3 d/wk, 60% HR$_{max}$, 15-20 min/d and RT 2 d/wk, 15RM, 1-2 sets × 15 reps, 8 exercises (2) Wk 5-10: 3 d/wk (1:1 supervision), 12RM, 3 sets × 12 reps (3) Wk 11-12: 3 d/wk (bi-weekly 1:1 supervision), 10RM, 3 sets × 10 reps (4) Wk 13-26: 3 d/wk (bi-weekly 1:1 supervision), 8RM, 3 sets × 8 reps. RT load increased based on the maximal weight that could be lifted for 7-9 reps. *Unsupervised sessions* were verified with exercise logs & scanning of membership cards.	-5.0/ -2.0	**-1.0/** **-1.0**
Con = 63/60 (35% W), *White (91%), Other (9%),* 55 yr, 35 kg/m^2, 133.0/80.0 mmHg (56%), T2DM + obesity & HTN (56%) & dyslipidemia (43%)	Wait-list Con	-4.0/ -1.0	
Sillanpää, 2009[63] (RCT, Finland, funding=2) RT = 15/15 (100% M), White, 54 yr, 24.9 kg/m^2, 129.0/83.0 mmHg (7%), MetS (7%) & dyslipidemia (7%)	**21 wk; *Supervised*** ***F***: 2 d/wk ***I***: 40-90% of 1-RM ***T***: 60-90 min/d; 3-4 sets × 6-20 reps for 7-8 exercises (3-4 UB/ 3 LB/ 1 Core) ***T***: Periodized, full-body RT ***P***: (1) Wk 0-7 (muscle endurance; fat reduction): 40-60% 1-RM, 3-4 sets × 15-20 reps (2) Wk 7-14 (hypertrophy; increase total muscle mass/fat ratio): 60-80% 1-RM, 3-4 sets × 10-15 reps (3) Wk 14-21 (maximal strength; optimize strength gains): 70-90% 1-RM, 3-4 sets × 6-8 reps. 1-RM was re-evaluated and adjusted mid-study.	-9.0/ -5.0	**-3.0/** **-2.0**
Con = 16/15 (100% M), White, 54 yr, 24.8 kg/m^2, 138.0/88.0 mmHg (7%), MetS (7%) & dyslipidemia (7%)	Wait-list Con	-6.0/ -3.0	
Sillanpää, 2009[64] (RCT, Finland, funding=2) RT = 17/17 (100% W), White, 51 yr, 22.7 kg/m^2, 119.0/71.0 mmHg, dyslipidemia (5.9%)	**21 wk; *Supervised*** ***F***: 3 d/wk ***I***: – ***T***: 60 min/d; 2-4 sets × 8-12 reps (until exhaustion) for 7 exercises (4 UB/ 1 LB/ 2 Core), 2 min rest b/w circuits ***T***: Progressive, full-body circuit RT ***P***: (1) Wk 0-2: 50% 1-RM, 2 sets × 10 reps (2) Wk 3-12: 8-12RM, 4 sets × 8-12 reps. RT load was re-evaluated at each session and adjusted.	0.0/ 0.0	**9.0/** **3.0**
Con = 13/12 (100% W), White, 51 yr, 23.2 kg/m^2, 130.0/76.0 mmHg (17%)	Wait-list Con	-9.0/ -3.0	
Simons, 2006[65] (RCT, US, funding=0) RT = 21/19 (71% W), White, 85 yr, –kg/m^2, 133.0/70.0 mmHg	**16 wk; *Supervised (small groups)*** ***F***: 2 d/wk ***I***: 75% 1-RM ***T***: 15-20 min/d; 1 set × 10 reps for 6 exercises (3 UB/ 3 LB) ***T***: Progressive, full-body RT ***P***: RT intensity/load increased 5% when subjects completed 10 reps, w/proper form for 3-5 consecutive sessions. Participants were encouraged to attend 6-part health lecture series offered every 3 wk (detailed below).	-9.0/ -2.0	**-10.0/** **-4.0**
Con = 21/20 (86% W), White, 84 yr, –kg/m^2, 128.0/68.0 mmHg	***F***: 1 d every 3 wk ***I***: – ***T***: 60 min/d ***T***: Placebo Con; 6-part health lecture series on topics related to: Aging in the 21st Century; Senior Fitness Program Development; Balance and Stability Training; Aging and the Mind; Aging and Nutrition	1.0/ 2.0	
Smutok, 1993[66] (Non-RCT, US, funding=0) RT = 16/14 (100% M), White, 48 yr, 29.2 kg/m^2, 137.0/85.0 mmHg, dyslipidemia (76%) & T2DM (54%) & HTN (30%)	**20 wk; *Supervised*** ***F***: 3 d/wk ***I***: 12-15RM (until volitional failure) ***T***: 2 sets × 12-15 reps for 12 exercises (6 UB/ 4 LB/ 2 Core), 90 s rest b/w sets ***T***: Progressive, full-body RT ***P***: RT load was adjusted at each session (as needed).	-2.0/ -2.0	**-3.0/** **-2.0**

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*F*requency, *I*ntensity, *T*ime, *T*ype and RT *P*rogression)**	**BP Δ #** ***Post-Pre***	 ***RT-Con***
Con = 12/10 (100% M), White, 50 yr, 29.5 kg/m^2, 128.0/84.0 mmHg, dyslipidemia (76%) & T2DM (54%) & HTN (30%)	Wait-list Con	1.0/ 0.0	
Spalding, 2004[67] (RCT, US, funding=0) † RT = 15/15 (60% W), *White (80%), Black (18%), Other (2%)*, 22 yr, –kg/m^2, 116.1/74.9 mmHg	**6 wk; *Supervised*** ***F***: 3-5 d/wk ***I***: 8-12RM (until volitional failure) ***T***: 40-45 min/d; 3 sets × 8-12 reps for 6 exercises (4 UB/ 2 LB) ***T***: Full-body RT ***P***: –	0.0/ -1.2	**-0.9/** **-1.6**
Con = 15/15 (40% W), *White (80%), Black (18%), Other (2%)*, 22 yr, –kg/m^2, 120.1/75.3 mmHg	Wait-list Con	0.9/ 0.4	
Stensvold, 2010[68] (RCT, Norway, funding=2) RT = 12/11 (–% W), White, 51 yr, 32 kg/m^2, 142.7/ 90.7 mmHg (18%), MetS	**12 wk; *Supervised*** ***F***: 3 d/wk (Program 1 × 2 d/wk + Program 2 × 1 d/wk) ***I***: 60-80% 1-RM ***T***: 40-50 min/d; 3 sets × 8-12 reps for 3-5 full-body RT exercises (Program 1: 2 UB/ 1 LB; Program 2: 4 UB/ 1 Core) ***T***: Full-body RT ***P***: –	-2.8/ -1.8	**-3.4/** **-1.2**
Con = 12/11 (–% W), White, 47 yr, 32 kg/m^2, 141.5/ 90.1 mmHg (18%), MetS	Wait-list Con	0.6/ -0.6	
Tanimoto, 2009[6] (RCT, Japan, funding=0) † *Heavy-load* RT = 12/12 (100% M), Asian, 19 yr, 20.6 kg/m^2, 108.3/59.4 mmHg	**13 wk** ***F***: 2 d/wk ***I***: 85-90% 1-RM ***T***: 3 sets × 8 reps (normal speed) for 5 exercises (2 UB/ 1 LB/ 2 Core), 60 s rest b/w sets and 3 min b/w exercises ***T***: Full-body RT ***P***: –	2.0/ 2.4	**2.8/** **1.7**
Low-load RT = 12/12 (100% M), Asian, 20 yr, 20.9 kg/m^2, 111.3/60.7 mmHg	***F***: 2 d/wk ***I***: 55-60% 1-RM ***T***: 3 sets × 8 reps (slow speed), 60 s rest b/w sets and 3 min b/w exercises ***T***: 5 full-body RT exercises (2 UB/ 1 LB/ 2 Core) ***P***: –	0.1/ -0.4	**0.9/** **-1.1**
Con = 12/12 (100% M), Asian, 20 yr, 21.1 kg/m^2, 108.4/59.3 mmHg	Wait-list Con	-0.8/ 0.7	
Terra, 2008[69] (Non-RCT, Brazil, funding=0) † RT = 23/20 (100% W), Hispanic/Latino, 67 yr, 28.3 kg/m^2, 125.2/72.0 mmHg (100%), HTN + T2DM (85%) & dyslipidemia (70%) & obesity (35%)	**12 wk** ***F***: 3 d/wk ***I***: 60-80% 1-RM ***T***: 3 sets × 8-12 reps for 11 exercises (3 UB/ 6 LB/ 2 Core), 60-90 s rest b/w exercises ***T***: Progressive, full-body RT ***P***: (1) Wk 1-4: 60% 1-RM, 3 sets × 12 reps, 60 s rest (2) Wk 5-8: 70% 1-RM, 3 sets × 10 reps, 60 s rest (3) Wk 9-12: 80% 1-RM 3 sets × 8 reps, 90 s rest.	-10.5/ -0.9	**-9.2/** **-0.1**
Con = 29/26 (100% W), Hispanic/Latino, 65 yr, 28.3 kg/m^2, 124.6/74.2 mmHg (100%), HTN + T2DM (85%) & dyslipidemia (70%) & obesity (35%)	Wait-list Con	-1.3/ -0.9	
Thomas, 2005[70] (RCT, China, funding=1) *Theraband* RT = 65/60 (46% W), Asian, 69 yr, 24.2 kg/m^2, 142.0/72.0 mmHg (23%); HTN (55%) + T2DM (10%) & dyslipidemia (59%) & obesity (40%)	**48 wk; *Supervised*** ***F***: 2 d/wk ***I***: – ***T***: 45 min/d; 1 set × 30 reps for 7 "forms of motion" (2 UB/ 4 LB/ 1 Core) ***T***: Full-body RT using Therabands® ***P***: –	-5.2/ -0.1	**-4.9/** **-1.2**
Con = 78/60 (44% W), Asian, 69 yr, 24.2 kg/m^2, 140.0/71.0 mmHg (31%); HTN (58%) + T2DM (8%) & dyslipidemia (55%) & obesity (37%)	Wait-list Con	-0.3/ 1.1	
Tseng, 2013[71] (RCT, Taiwan, funding=1) RT = 11/10 (100% M), Asian, 21 yr, 30.4 kg/m^2, 124.0/77.7 mmHg	**12 wk; *Supervised*** ***F***: 5 d/wk ***I***: 50-80% 1-RM ***T***: 60 min/d (including 10 min warm-up/cooldown); 3 sets × 8-15 reps, ***T***: 10 exercises (5 UB/ 3 LB/ 2 Core) ***P***: (1) Wk 1-4: 50-60% 1-RM, 3 sets × 12-15 reps (2) Wk 5-8: 60-70% 1-RM, 3 sets × 10-12 reps (3) Wk 9-12: 70-80% 1-RM, 3 sets × 8-10 reps. Participants also attended 3 "healthy living" lectures (detailed below).	-5.4/ -4.3	**-5.8/** **-4.1**

Study Details *† and Baseline Sample Characteristics ‡§||	**Features of the Dynamic RT and Con Interventions ¶ (*F*requency, *I*ntensity, *T*ime, *T*ype and RT *P*rogression)**	**BP Δ #**	
		Post-Pre	***RT-Con***
Con = 11/10 (100% M), Asian, 22 yr, 31 kg/m^2, 126.0/81.7 mmHg	***F***: 1 d every 4 wk (supervised) ***I***: – ***T***: – ***T***: Placebo Con; attended 3 "healthy living" lectures (i.e., health education for a proper diet): (1) Physician-led, topic: MetS; (2) Nutritionist-led, topic: Caloric Content of Foods; (3) Physical Education Teacher-led, topic: Exercise and Fitness Testing Procedures.	0.4/ -0.2	
Tsutsumi, 1997[7] (RCT, US, funding=0) †	**12 wk; *Supervised***		
Heavy-load RT = 14/13 (15% W), *White (96%),* 68 yr, –kg/m^2, 109.8/65.0 mmHg	***F***: 3 d/wk ***I***: 75-85% 1-RM ***T***: 2 sets × 8-12 reps for 12 exercises (8 UB/ 2 LB/ 2 Core), 1-2 min rest b/w sets ***T***: Progressive, full-body RT ***P***: RT load increased 5-20% every 4-6 sessions (as needed).	-6.1/ 0.0	**-7.1/ 1.0**
Low-load RT = 14/14 (21% W), *White (96%),* 69 yr, –kg/m^2, 124.2/72.6 mmHg	***F***: 3 d/wk ***I***: 55-65% 1-RM ***T***: 2 sets × 12-16 reps for 12 exercises (8 UB/ 2 LB/ 2 Core), 1-2 min rest b/w sets ***T***: Progressive, full-body RT ***P***: RT load increased 5-20% every 4-6 sessions (as needed).	-13.4/ -2.1	**-14.4/ -2.1**
Con = 14/14 (21% W), *White (96%)*, 70 yr, –kg/m^2, 122.0/72.4 mmHg	Wait-list Con	0.0/ 0.0	
Tsuzuku, 2007[72] (Non-RCT, Japan, funding=2) †	**12 wk; *Supervised* × *1 d/wk at clinic* + *Unsupervised* × *2 d/wk at home***		
RT= 32/32 (63% W), Asian, 69 yr, 22.9 kg/m^2, 131.5/72.4 mmHg	***F***: 3 d/wk ***I***: – ***T***: 40–50 min/d; 2 sets × 10-14 reps for 7 exercises (3 UB/ 3 LB/ 1 Core) ***T***: Progressive, full-body RT (bodyweight exercises & Therabands®) ***P***: RT reps were increased every 4 wk (e.g., 10, 12, 14 reps); Therabands® were used for 2 UB exercises (seated row, shoulder press). *Supervision* – Licensed instructors supervised clinic sessions; home-based training logs were submitted weekly to assess adherence.	-5.1/ -5.1	**-8.6/ -8.0**
Con = 20/20 (50% W), Asian, 70 yr, 22.7 kg/m^2, 124.4/67.9 mmHg	Wait-list Con	3.5/ 2.9	
Van Hoof, 1996[73] (RCT, Belgium, funding=1)	**16 wk; *Supervised***		
RT = 15/8 (100% M), White, –yr, –kg/m^2, 129.0/ 81.0 mmHg	***F***: 3 d/wk ***I***: 70% 1-RM ***T***: 3 sets × 10-12 reps for 6 exercises (2 UB/ 3 LB/ 1 Core), 3 min of "active" rest b/w exercises ***T***: Progressive, full-body RT ***P***: Wk 4-16: Further adaptation for bench press and leg press: 70% 1-RM, 3 sets × 10 reps, then 90% 1-RM × 4 reps (14 reps total per exercise). 1-RM values were evaluated every 4 sessions and adjusted.	-4.0/ -5.0	**0.0/ -3.0**
Con = 15/11 (100% M), White, –yr, –kg/m^2, 124.0/ 78.0 mmHg	Wait-list Con	-4.0/ -2.0	
Vincent, 2003[8] (RCT, US, funding=0)	**24 wk; *Supervised***		
Heavy-load RT = 30/24 (55% W), White, 67 yr, 26.5 kg/m^2, 132.9/63.4 mmHg	***F***: 3 d/wk ***I***: 80% 1-RM ***T***: 1 set × 8 reps for 13 exercises (5 UB/ 6 LB/ 2 Core) ***T***: Progressive, full-body RT ***P***: RT load increased 5% when RPE ratings dropped below 18.	-3.2/ -2.3	**-2.3/ -5.6**
Low-load RT = 34/22 (55% W), White, 68 yr, 27.7 kg/m^2, 137.0/60.7 mmHg	***F***: 3 d/wk ***I***: 50% 1-RM ***T***: 1 set × 13 reps for 13 exercises (5 UB/ 6 LB/ 2 Core) ***T***: Progressive, full-body RT ***P***: RT load increased 5% when RPE ratings dropped below 18.	1.9/ 2.9	**2.8/ -0.4**
Con = 20/16 (55% W), White, 71 yr, 25.3 kg/m^2, 130.2/76.2 mmHg	Wait-list Con	-0.9/ 3.3	
Williams, 2013[74] (X-RCT, Australia, funding=2)	**16 wk; *Supervised (small groups)* × *2 d/wk* + *Unsupervised* × *1 d/wk***		
RT = 25/25 (53% W), White, 67 yr, 28 kg/m^2, 135.0/ 83.0 mmHg (24%)	***F***: 2-3 d/wk ***I***: 8-12RM (14–17 RPE rating on Borg 6–20 scale) ***T***: 2-3 sets × 8-12 reps for 4-5 exercises (2 UB/ 2-3 LB) ***T***: Progressive, full-body RT ***P***: (1) Wk 0-4 Adaptation phase: 2 d/wk, 8-12RM, 2 sets × 8-12 reps performed in groups (10-14 participants) (2) Wk 5-16: 2 d/wk *(supervised)* + 1 d/wk *(unsupervised)*, 8-12RM, 3 sets × 8-12 reps. RT load increased 2-10 kg (10–20%) when >12 reps could be completed in the final set (maintain 14-17 RPE). Training diaries assessed home-based program compliance. *Intervention details provided in Williams et al.*[75]	0.0/ -3.0	**0.0/ -2.6**
Con = 24/24 (53% W), White, 66 yr, 28 kg/m^2, 135.0/86.0 mmHg	***F***: 2-3 d/wk ***I***: – ***T***: 12 exercises in total (i.e., ≥2 exercises/major muscle groups: quadriceps, hamstrings, back and chest) ***T***: Placebo Con; full-body static stretching program ***P***: (1) Wk 0-4: 2 d/wk, performed in small groups (10-14	0.0/ -2.5	

Study Details *† and Baseline Sample Characteristics ‡§‖	**Features of the Dynamic RT and Con Interventions ¶ (Frequency, Intensity, Time, Type and RT Progression)**	**BP Δ #**	
		Post-Pre	***RT-Con***
	participants) (2) Wk 5-12: 2 d/wk *(supervised)* + 1 d/wk of home-based *(unsupervised)* program. Training diaries assessed compliance to home-based program.		
Wood, 2001[76] (RCT, US, funding=0) † RT = 10/10 (50% W), White, 70 yr, 27.3 kg/m^2, 129.1/75.1 mmHg	**12 wk** ***F*: 3 d/wk *I*: 75% 5RM to 8-12RM *T*: 1-2 sets × 8-15 reps for 8 exercises (5 UB/ 3 LB) *T*: Progressive, full-body RT *P*: (1) Wk 0-4: 75% 5RM (increased 5-10% until 8-12RM was reached), 1 set × 12-15 reps (2) Wk 4-12: 100% 8-12RM, 2 sets × 8-12 reps; increased 5-10% when >12 reps were performed)	-5.0/ -2.5	**-1.2/ -4.5**
Con = 6/6 (50% W), White, 68 yr, 27.4 kg/m^2, 133.5/78.3 mmHg	Wait-list Con	-3.8/ 2.0	
Yoshiwaza, 2009[77] (RCT, Japan, funding=2) RT = 11/11 (100% W), Asian, 47 yr, 24.8 kg/m^2, 122.0/78.0 mmHg	**12 wk** ***F*: 2 d/wk *I*: 60% 1-RM *T*: 3 sets × 10 reps for 6 exercises (1 UB/ 4 LB/ 1 Core) *T*: Full-body RT *P*: ─	-5.0/ -3.0	**-3.0/ -1.0**
Con = 12/12 (100% W), Asian, 49 yr, 21.8 kg/m^2, 118.0/73.0 mmHg	Wait-list Con	-2.0/ -2.0	
Zavanela, 2012[78] (Non-RCT, Brazil, funding=0) RT = 72/48 (100% M), Hispanic/Latino, –yr, 25.4 kg/m^2, 123.7/81.7 mmHg	**24 wk; *Supervised*** ***F*: 3-4 d/wk *I*: 10-12RM *T*: 3 sets × 10-12 reps for 8-12 exercises, 1 min rest b/w sets & exercises *T*: Progressive, full-body RT *P*: (1) Wk 0-1: Familiarization & 1-RM testing (2) Wk 1-8: 3 d/wk, 10-12RM, 3 sets × 10-12 reps, 12 exercises (5 UB/ 5 LB/ 2 Core) (3) Wk 9-24 (Split-RT): 4 d/wk, 10-12RM, 3 sets × 10-12 reps, 9 (6 UB/ 2 LB/ 1 Core, Program A) or 8 (4 UB/ 3 LB/ 1 Core, Program B) exercises. 1-RM was re-evaluated and adjusted monthly.	-6.6/ -4.2	**-9.7/ -7.9**
Con = 60/48 (100% M), Hispanic/Latino, –yr, 26.6 kg/m^2, 125.1/ 83.0 mmHg	Wait-list Con	3.1/ 3.7	

Notes. ─ indicates missing/unreported information; Δ, change; b/w, between; BP, blood pressure; con, control; core, exercises that targeted muscle groups other than UB/LB (i.e., abdominals, hips, lower/mid-back); CVD, cardiovascular disease; DBP, diastolic BP; heavy-load, high intensity; HTN, hypertension; LB, lower body; low-load, light intensity; M, men; MetS, metabolic syndrome; moderate-load, moderate intensity; NAFLD, non-alcoholic fatty liver disease; SBP, systolic BP; RCT, randomized controlled trial; RT, resistance training. RM, repetition maximum; T2DM, type 2 diabetes mellitus; UB, upper body; UK, United Kingdom; US, United States; W, women; X-RCT, cross-over design, RCT.

***** Study details: First Author, Publication Year (study design, geographical study location, total number of reported funding sources).

† BP-focused primary study outcome.

‡ Sample characteristics: Number of RT and Con participants that started/completed the intervention (% of women or men), race/ethnicity, age (in years), body mass index (in kg/m^2), resting SBP/DBP (% reportedly taking BP medications), CVD-related chronic diseases and/or health conditions (if any).

§ Race/ethnicity: Racial/ethnic breakdown is *italicized (% of the total sample)* for the 9 studies that reported this information; when unreported, race/ethnicity was estimated based on the geographical study location.

‖ CVD-related chronic diseases (T2DM, heart failure, CVD, NAFLD) and/or health conditions (HTN, dyslipidemia, obesity, MetS) are provided when applicable; if a subset of the sample has the disease and/or condition (but not all), the proportion is provided in parentheses.

¶ Intervention length (in weeks); the level of supervision is provided when possible.

\# BP Δ: *Post – Pre* = SBP/DBP (mmHg) change for the RT and Con groups at post- *vs.* pre-intervention (unweighted). RT *vs.* Con = Standardized mean SBP/DBP difference for the RT compared to Con group that was arithmetically back-translated (i.e., transformed) to the original metric, mmHg.

Table S4. Summary of the overall methodological study quality, individual quality items, and quality subscales for the included dynamic resistance training interventions (*k*=71) gauged using the augmented Downs and Black Checklist.

Quality Items *	Level of Satisfaction (*k,* %)								Study Quality Subscales †	
	Fully		Partially		*NS*	*UD*	Unsatisfied		Study Quality Points	% of Quality Items Satisfied
Reporting (11 Possible points)									**8.6 ± 1.1 (8.5; 4.0 – 10.5)**	**78.6 ± 10.2% (77.3; 36.4 – 95.5)**
Item 1	71	100.0%	—		0	—	0	0.0%		
Item 2	71	100.0%	—		0	—	0	0.0%		
Item 3	69	97.2%	—		0	2	2	2.8%		
Item 4 *	30	42.3%	33	46.5%	8	—	8	11.3%		
Item 5 *	36	50.7%	30	42.3%	5	—	5	7.0%		
Item 6 *	29	40.8%	25	35.2%	7	10	17	23.9%		
Item 7	67	94.4%	—		4	—	4	5.6%		
Item 8	69	97.2%	—		2	—	2	2.8%		
Item 9	70	98.6%	—		1	—	1	1.4%		
Item 10	65	91.5%	—		5	1	6	8.5%		
Item 11	27	38.0%	—		42	2	44	62.0%		
External Validity (3 possible points)									**1.4 ± 1.3 (2.0; 0.0 – 3.0)**	**46.5 ± 42.3% (66.7; 0.0 – 100.0)**
Item 12	36	50.7%	—		0	35	0	49.3%		
Item 13	36	50.7%	—		0	35	0	49.3%		
Item 14	27	38.0%	—		0	44	0	62.0%		
Internal Validity – Bias (7 possible points)									**4.9 ± 1.0 (5.0; 3.0 – 7.0)**	**70.2 ± 14.9% (71.4; 42.9 – 100.0)**
Item 15	26	36.6%	—		39	6	45	63.4%		
Item 16	25	35.2%	—		8	38	46	64.8%		
Item 17	71	100.0%	—		0	—	0	0.0%		
Item 18	69	97.2%	—		2	—	0	2.8%		
Item 19	70	98.6%	—		0	1	1	1.4%		
Item 20	49	69.0%	—		0	22	22	31.0%		
Item 21 *	31	43.7%	16	22.5%	21	3	24	33.8%		
Internal Validity – Confounding (6 Possible Points)									**3.1 ± 1.8 (3.0; 0.0 – 6.0)**	**51.5 ± 30.1% (50.0; 0.0 – 100.0)**
Item 22	36	50.7%	—		0	35	35	49.3%		
Item 23	38	53.5%	—		0	33	33	46.5%		
Item 24 *	14	19.7%	45	63.4%	12	—	12	16.9%		
Item 25	26	36.6%	—		39	6	45	63.4%		
Item 26	51	71.8%	—		0	20	20	28.2%		
Item 27	32	45.1%	—		38	1	39	54.9%		
Power ‡ (2 possible points)									**0.2 ± 0.5 (0.0; 0.0 – 2.0)**	**9.2 ± 24.4% (0.0; 0.0 – 100.0)**
Item 28	3	4.2%	7	9.9%	61	—	61	85.9%		
Total Study Quality Score (29 Possible Points)									**18.2 ± 3.7 (18.0; 12.0 – 24.5)**	**62.9 ± 12.9% (62.1; 41.4 – 84.5)**

Note. — indicates the item is not applicable; *k*, number of observations; NS, not satisfied; UD, unable to determine. * Items could be fully *or partially* satisfied; 1 point was awarded to trials that fully satisfied these items; partially satisfied=0.5 points. **†** Reported as *Mean* ± *SD* (Median; Range=Minimum**–**Maximum values). **‡** Power=2 points were awarded to trials that fully satisfied Item 28; partially satisfied=1 point.

Table S5. Item-by-item summary of methodological study quality for the included dynamic resistance training intervention (*k*=71) gauged using the augmented version of the Downs and Black Checklist.

Author, Year	Reporting											External Validity			Internal Validity – Bias							Internal Validity – Confounding						Power	Overall MSQ Score*	
(RT Subgroup)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28†	(29-points)	
Anton, 2006[17]	1	1	0	½	½	1	1	1	1	1	0	—	—	—	0	1	1	1	1	1	—	—	—	½	0	1	0	0	14.5	50.0%
Arora, 2009[18]	1	1	0	½	½	½	1	1	1	1	0	1	1	1	—	—	1	1	1	1	0	1	1	½	1	—	1	0	19.0	65.5%
Bateman, 2011[19]	1	1	1	1	1	½	1	1	1	1	—	1	1	1	1	1	1	1	1	1	0	1	1	½	1	1	1	0	24.0	82.8%
Beck, 2013[20]	1	1	0	½	½	½	1	1	1	1	—	1	1	1	1	—	1	1	1	1	1	1	1	1	1	1	1	0	22.5	77.6%
Blumenthal, 1991[21]	1	1	1	½	0	1	1	1	1	1	1	1	1	—	0	1	1	1	1	1	1	1	1	½	0	1	0	0	21.0	72.4%
Carter, 2003[22]	1	1	1	1	½	½	1	1	1	1	1	—	—	—	0	—	1	0	1	1	1	—	—	0	0	1	0	0	15.0	51.7%
Casey, 2007[23]	1	1	0	1	½	½	1	1	1	1	0	—	—	1	0	1	1	1	1	1	1	—	—	0	0	1	0	0	16.0	55.2%
Castaneda, 2002[24]	1	1	0	½	1	½	1	1	1	1	1	1	1	1	1	—	1	1	1	1	0	1	1	1	1	1	1	0	23.0	79.3%
Chaudhary, 2010[25]	1	0	—	0	½	—	1	1	1	1	1	—	—	—	—	—	1	1	1	—	½	—	1	0	—	—	1	0	12.0	41.4%
Colado, 2009 (Aquatic)[2]	1	1	1	1	1	1	1	1	1	1	0	1	1	—	0	—	1	1	1	1	0	1	1	½	0	—	0	0	18.5	63.8%
Colado, 2009 (Therabands)[2]	1	1	1	1	1	1	1	1	1	1	0	1	1	—	0	—	1	1	1	1	0	1	1	½	0	—	0	0	18.5	63.8%
Concieção, 2013[26]	1	1	1	1	½	—	1	1	1	—	1	1	1	—	1	—	1	1	1	—	½	1	1	1	1	—	—	2	21.0	72.4%
Cononie, 1991[27]	1	1	1	1	½	½	1	1	1	1	0	—	—	1	0	1	1	1	1	1	1	—	—	0	0	1	0	0	17.0	58.6%
Cortez-Cooper, 2005[29]	1	1	0	1	½	½	1	1	1	1	0	—	—	—	0	—	1	1	1	1	½	—	—	0	0	—	0	0	12.5	43.1%
Cortez-Cooper, 2008[30]	1	1	0	1	½	½	1	1	1	1	0	1	1	—	0	1	1	1	1	1	1	1	1	½	0	1	0	0	19.5	67.2%
Croymans, 2014[31]	1	1	1	1	1	½	1	1	1	1	1	—	—	1	1	1	1	1	1	1	1	—	1	1	1	1	1	1	24.5	84.5%
Elliot, 2002[32]	1	1	0	1	½	1	1	1	1	1	1	—	—	1	0	1	1	1	1	—	1	—	—	½	0	—	0	0	16.0	55.2%
Gelecek, 2012[33]	1	1	1	½	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	½	1	1	1	0	24.0	82.8%
Gerage, 2013[34]	1	1	1	1	½	½	1	1	1	1	1	1	1	—	1	—	1	1	1	1	½	1	1	1	1	1	1	1	24.5	84.5%
Gurjão, 2013[35]	1	1	1	½	1	½	1	1	1	1	1	1	1	—	1	—	1	1	1	1	½	1	1	1	1	1	1	0	23.5	81.0%
Harris, 1987[36]	1	1	1	1	1	½	1	1	1	1	0	—	—	—	0	0	1	1	1	—	1	—	—	½	0	1	0	0	15.0	51.7%
Ho, 2012[37]	1	1	1	0	½	1	1	1	1	1	1	1	1	1	1	—	1	1	1	—	1	1	1	½	—	—	1	1	22.0	75.9%
Hu, 2009[39]	1	1	0	1	0	—	1	1	1	1	0	1	1	—	1	—	1	1	1	1	0	1	1	1	1	—	1	0	19.0	65.5%
Jakovljevic, 2013[41]	1	1	1	½	½	—	1	1	1	1	1	1	1	—	1	—	1	1	1	—	½	1	1	1	1	1	1	0	21.5	74.1%
Jorge, 2011[42]	1	1	0	½	0	1	1	1	1	1	0	1	1	1	1	—	1	1	1	1	0	1	1	½	1	1	1	0	21.0	72.4%
Kanegusuku, 2011 (Power)[3]	1	1	1	1	1	1	1	1	1	1	0	—	—	—	0	0	1	1	1	1	1	—	—	½	0	1	0	0	16.5	56.9%
Kanegusuku, 2011 (Strength)[3]	1	1	1	1	1	1	1	1	1	1	0	—	—	—	0	0	1	1	1	1	1	—	—	½	0	1	0	0	16.5	56.9%
Katz, 1992[43]	1	1	1	0	1	—	1	1	1	0	1	—	—	—	1	—	1	1	—	—	½	—	—	1	1	—	1	0	14.5	50.0%
Kawano, 2006[44]	1	1	0	½	1	1	1	1	1	1	0	—	—	—	0	—	1	1	1	1	1	—	—	½	0	1	0	0	15.0	51.7%
Locks, 2012[45]	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	—	1	1	1	1	1	1	1	½	1	—	1	1	22.5	77.6%

Author, Year (RT Subgroup)	Reporting											External Validity			Internal Validity – Bias							Internal Validity – Confounding						Power	Overall MSQ Score* (29-points)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28†		
Lovell, 2009[46]	1	1	1	1	1	½	1	1	1	1	1	—	—	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24.5	84.5%
Marioana, 2011[47]	1	1	0	1	0	1	1	1	1	1	0	—	—	1	0	1	1	1	1	1	0	—	—	½	0	—	0	0	14.5	50.0%
Miyachi, 2004[48]	1	1	0	½	1	1	1	1	1	1	0	—	—	—	0	—	1	1	1	1	1	—	—	½	0	1	0	0	15.0	51.7%
Mota, 2013[49]	1	1	1	½	1	—	1	1	1	1	1	—	—	—	—	—	1	1	1	—	1	—	—	0	—	1	1	0	15.5	53.4%
Norris, 1990[50]	1	0	1	0	0	0	1	1	0	0	0	1	1	1	0	—	1	1	1	—	0	1	1	0	0	—	0	0	12.0	41.4%
Nybo, 2010 (Lower body)[51]	1	1	1	1	1	½	1	1	1	1	0	—	—	—	—	—	1	1	1	—	1	—	—	0	—	—	1	0	14.5	50.0%
Okamoto, 2006 (Concentric)[4]	1	1	0	½	½	1	1	1	1	1	0	—	—	—	0	—	1	1	1	1	0	—	—	½	0	1	0	0	13.5	46.6%
Okamoto, 2006 (Eccentric)[4]	1	1	0	½	½	1	1	1	1	1	0	—	—	—	0	—	1	1	1	1	0	—	—	½	0	1	0	0	13.5	46.6%
Okamoto, 2011[52]	1	1	0	1	1	½	1	1	1	1	0	—	—	—	1	1	1	1	1	—	½	—	—	1	1	1	1	0	18.0	62.1%
Oliviera, 2012[53]	1	1	0	½	1	½	1	1	1	1	1	1	1	1	1	—	1	1	1	1	0	1	1	1	1	1	1	0	23.0	79.3%
Olson, 2007[54]	1	1	0	1	½	½	1	1	1	1	0	—	—	—	0	1	1	1	1	—	1	—	—	½	0	1	0	1	15.5	53.4%
Park, 2011[55]	1	1	1	½	½	0	1	1	1	0	1	1	1	1	0	—	1	1	1	1	0	1	1	½	0	1	0	1	19.5	67.2%
Reis, 2012[56]	1	1	0	1	1	½	1	1	1	1	0	1	1	—	1	1	1	1	1	—	0	1	1	½	1	1	1	0	21.0	72.4%
Sallinen, 2007[57]	1	1	1	1	1	1	0	1	1	1	0	—	—	—	0	1	1	1	1	1	1	—	—	½	0	—	0	0	15.5	53.4%
Sarsan, 2006[59]	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	½	1	1	½	0	1	0	0	21.0	72.4%
Shaw, 2010[60]	1	1	1	½	1	—	1	1	1	1	1	—	—	—	—	—	1	1	1	1	½	—	—	0	—	1	1	0	16.0	55.2%
Sheikholeslami, 2011 (Heavy)[5]	1	1	1	½	1	0	1	1	1	1	0	1	1	—	1	—	1	1	1	—	0	1	1	½	1	—	1	0	16.5	56.9%
Sheikholeslami, 2011 (Mod)[5]	1	1	1	½	1	0	1	1	1	1	0	1	1	—	1	—	1	1	1	—	0	1	1	½	1	—	1	0	19.0	65.5%
Sheikholeslami, 2012[61]	1	1	1	½	1	0	1	1	1	1	0	—	—	—	1	—	1	1	1	—	½	—	—	½	1	1	1	0	19.0	65.5%
Sigal, 2007[62]	1	1	0	½	½	1	1	1	1	1	1	1	1	1	0	—	1	1	1	1	½	1	1	½	0	1	1	2	23.0	79.3%
Sillanpää, 2009[63]	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	½	0	1	0	0	21.5	74.1%
Sillanpää, 2009[64]	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	½	0	1	0	0	22.5	77.6%
Simons, 2006[65]	1	1	0	0	½	1	1	1	1	1	0	1	1	1	0	—	1	1	1	1	0	1	1	½	0	1	0	0	18.0	62.1%
Smutok, 1993[66]	1	1	1	½	½	½	1	1	1	1	0	—	—	—	—	—	1	1	1	1	0	—	—	0	—	1	1	0	14.5	50.0%
Spalding, 2004[67]	1	1	1	0	½	—	1	1	1	1	0	1	1	—	1	1	1	1	1	1	1	1	1	1	1	—	1	0	21.5	74.1%
Stensvold, 2010[68]	1	1	1	½	1	—	1	1	1	1	1	1	1	—	1	1	1	1	1	1	½	1	1	½	1	—	1	0	22.5	77.6%
Tanimoto, 2009 (Heavy)[6]	1	1	1	½	½	1	1	1	1	1	0	—	—	—	0	—	1	1	1	—	½	—	—	½	0	1	0	0	14.0	48.3%
Tanimoto, 2009 (Low)[6]	1	1	1	½	½	1	1	1	1	1	0	—	—	—	0	—	1	1	1	—	½	—	—	½	0	1	0	0	14.0	48.3%
Terra, 2008[69]	1	1	1	½	1	½	1	1	1	1	1	1	1	—	0	1	1	1	1	—	1	—	—	0	0	1	0	0	18.0	62.1%
Thomas, 2005[70]	1	1	0	½	½	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	½	0	1	0	0	20.5	70.7%
Tseng, 2013[71]	1	1	0	½	1	½	1	1	1	1	1	1	1	1	1	1	1	1	1	—	0	1	1	1	1	1	1	0	23.0	79.3%
Tsutsumi, 1997 (Heavy)[7]	1	1	1	1	1	1	0	0	1	1	0	—	—	—	0	0	1	1	1	1	—	—	—	½	0	1	0	0	13.5	46.6%

Author, Year (RT Subgroup)	**Reporting**											**External Validity**			**Internal Validity – Bias**							**Internal Validity – Confounding**						**Power**	**Overall MSQ Score* (29-points)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28†**		
Tsutsumi, 1997 (Low)[7]	1	1	1	1	1	1	0	0	1	1	0	—	—	—	0	0	1	1	1	1	—	—	—	½	0	1	0	0	13.5	46.6%
Tsuzuku, 2007[72]	1	1	1	½	½	½	1	1	1	1	0	1	1	—	0	—	1	1	1	1	½	1	1	0	0	1	0	0	18.0	62.1%
Van Hoof, 1996[73]	1	1	0	½	1	1	1	1	1	1	1	—	—	—	0	1	1	1	1	1	1	—	—	½	0	1	0	0	17.0	58.6%
Vincent, 2003 (Heavy)[8]	1	1	0	½	½	1	1	1	1	1	0	—	—	1	0	0	1	1	1	1	1	—	—	½	0	1	0	0	15.5	53.4%
Vincent, 2003 (Low)[8]	1	1	0	½	½	1	1	1	1	1	0	—	—	1	0	0	1	1	1	1	1	—	—	½	0	1	0	0	15.5	53.4%
Williams, 2013[74]	1	1	0	½	½	½	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	½	1	1	1	2	24.0	82.8%
Wood, 2001[76]	1	1	1	1	½	1	1	1	1	1	0	—	—	—	0	—	1	1	1	—	0	—	—	½	0	1	0	0	14.0	48.3%
Yoshiwaza, 2009[77]	1	1	0	1	1	½	1	1	1	0	0	—	—	—	0	—	1	1	1	—	0	—	—	½	0	1	0	0	12.0	41.4%
Zavanela, 2012[78]	1	1	—	0	1	—	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	½	1	—	1	0	21.5	74.1%

Note. Heavy indicates heavy load/high intensity RT; low, low load/light intensity RT; mod, moderate load/moderate intensity RT; MSQ, methodological study quality; RT, resistance training.

* MSQ scoring: 1=Fully satisfied. 0=Not fully satisfied. ½=Partially satisfied quality item. — Unable to determine.

† Item 28: 1=Power analysis reported for one study outcome; 2= Power analysis reported for two or more study outcomes.

Table S7. The antihypertensive effects of dynamic resistance training versus control: Weighted mean effect sizes and test for homogeneity for systolic and diastolic blood pressure.

Intervention Group	Systolic BP						
			Homogeneity of *d*s †			BP Difference (mmHg) ‡	
	k	***d*₊ (95% *CI*) ***	***Q***	***p***	***I*² (95% *CI*)**	***Mean* (95% *CI*)**	**Min, Max**
Within-group							
Control	70	-0.04 (-0.10, +0.03)	66.3	0.571	0.0% (0.0, 31.0)	-1.0 (-2.0, -0.1)	-11.7, +8.0
RT	71	-0.34 (-0.43, -0.25)	132.6	<0.001	47.2% (30.2, 60.0)	-4.9 (-6.1, -3.8)	-15.0, +4.0
Between-group							
RT *vs.* Control	71	-0.31 (-0.43, -0.19)	143.4	<0.001	51.2% (35.9, 62.9)	-3.0 (-4.2, -1.9)	-18.6, +9.0

Intervention Group	Diastolic BP						
			Homogeneity of *d*s †			BP Difference (mmHg) ‡	
	k	***d*₊ (95% *CI*) ***	***Q***	***p***	***I*² (95% *CI*)**	***Mean* (95% *CI*)**	**Min, Max**
Within-group							
Control	70	-0.03 (-0.10, +0.05)	88.9	0.054	22.3% (0.0, 42.8)	-0.5 (-1.2, +0.2)	-10.5, +5.0
RT	71	-0.30 (-0.38, -0.22)	106.5	0.003	34.4% (11.9, 51.0)	-2.9 (-3.5, -2.2)	-11.0, +4.0
Between-group							
RT *vs.* Control	71	-0.28 (-0.38, -0.18)	107.6	0.003	35.0% (12.9, 51.5)	-2.1 (-2.8, -1.4)	-10.0, +5.0

Note. This model follows mixed-effects assumptions. BP indicates blood pressure; *CI*, confidence interval; *k*, number of observations in the model; min, minimum; max, maximum; RT, resistance training.

***** Weighted mean effect sizes (d_+) are negative when BP is at lower post- compared to pre-intervention (i.e., *within-group*) or when RT reduced BP to a greater extent than control (i.e., *between-group*).

† Tests for homogeneity: The *Q* statistic (or Cochran's *Q*)[13] indicates whether significant heterogeneity is *present* (or not). The I^2 statistic[14,15] quantifies the amount of heterogeneity (i.e., the *degree* or *level* of inconsistency across results) that ranges from 0% to 100%; tentative cut-points for low, moderate, and high correspond to 25%, 50%, and 75%, respectively.

‡ BP Difference: *Within-group* represents the change in BP post- compared to pre-intervention; *Between-group* represents the change in BP post- compared to pre-intervention for RT relative to control.

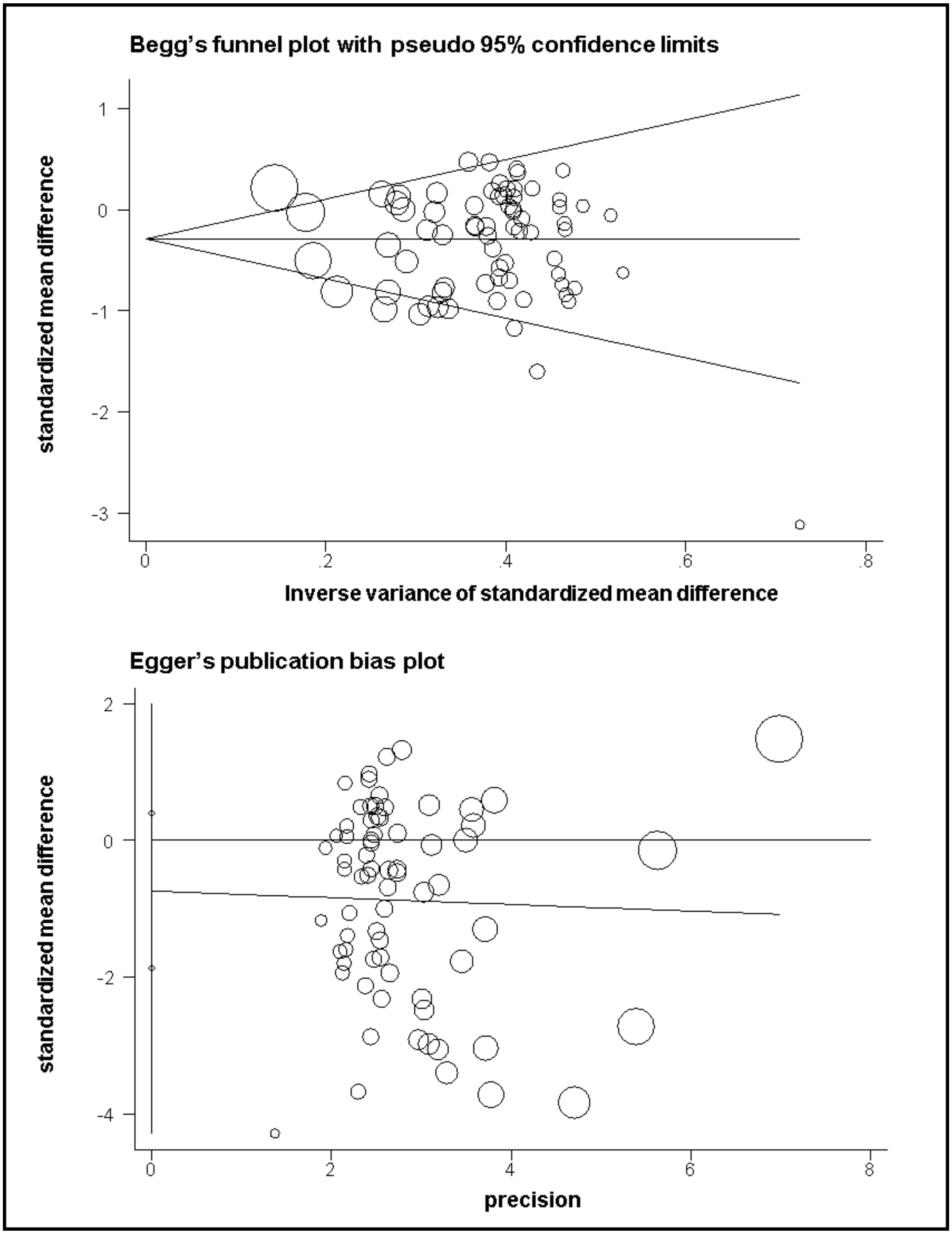
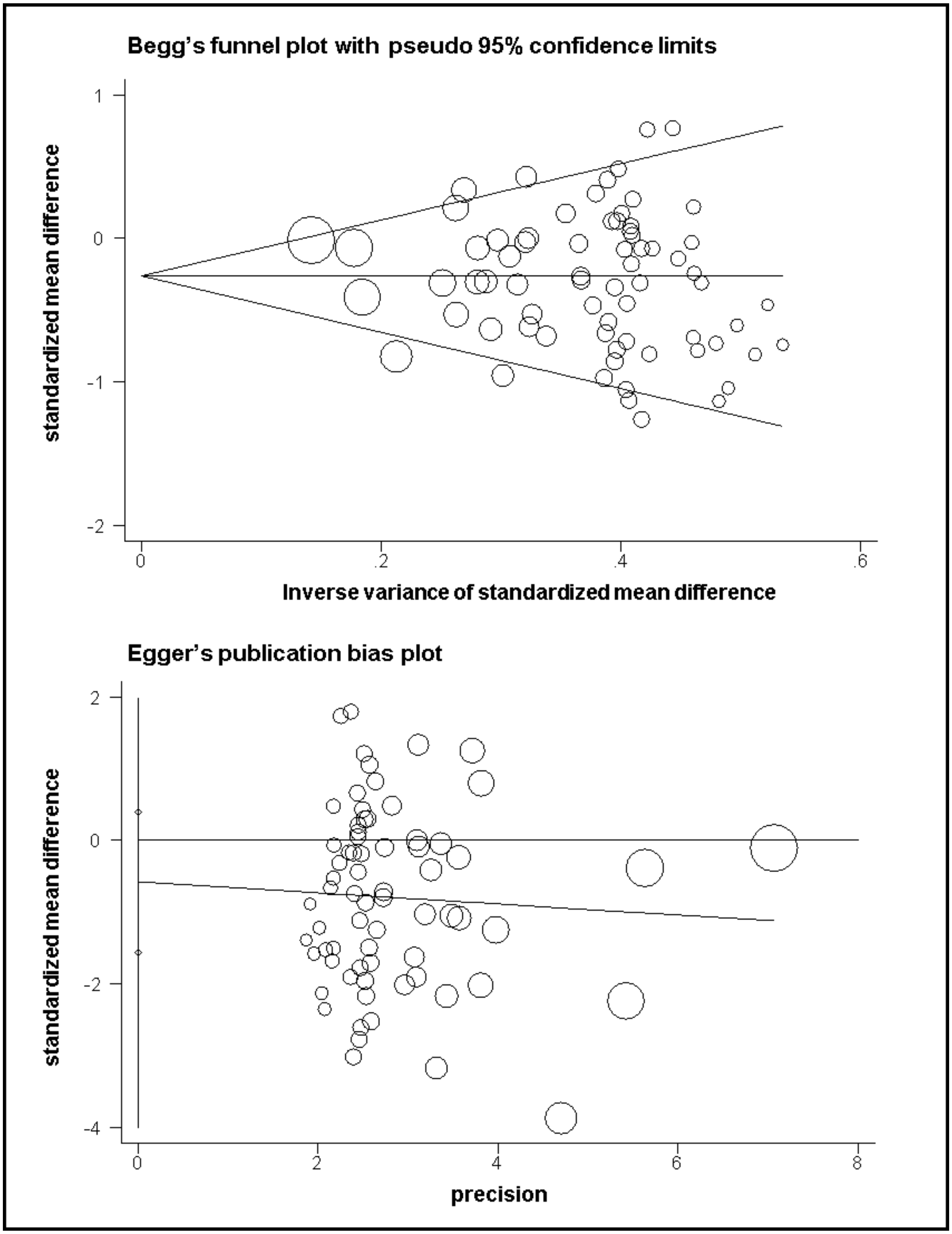


Figure S1. Tests for publication bias using Begg and Egger methods: Systolic blood pressure. Plots represent the standardized mean difference for dynamic resistance training versus control. Data points are weighted and sized proportional to the inverse variance. Tests for publication bias were negative: Begg's test: *z*= -0.46, *p*=0.64. Egger's test: *t*= -1.30, *p*=0.20.


Begg's funnel plot with pseudo 95% confidence limits

Egger's publication bias plot

Figure S2. Tests for publication bias using Begg and Egger methods: Diastolic blood pressure. Plots represent the standardized mean difference for dynamic resistance training versus control. Data points are weighted and sized proportional to the inverse variance. Tests for publication bias were negative: Begg's test: z= -1.32, p=0.19. Egger's test: t= -1.19, p=0.24.

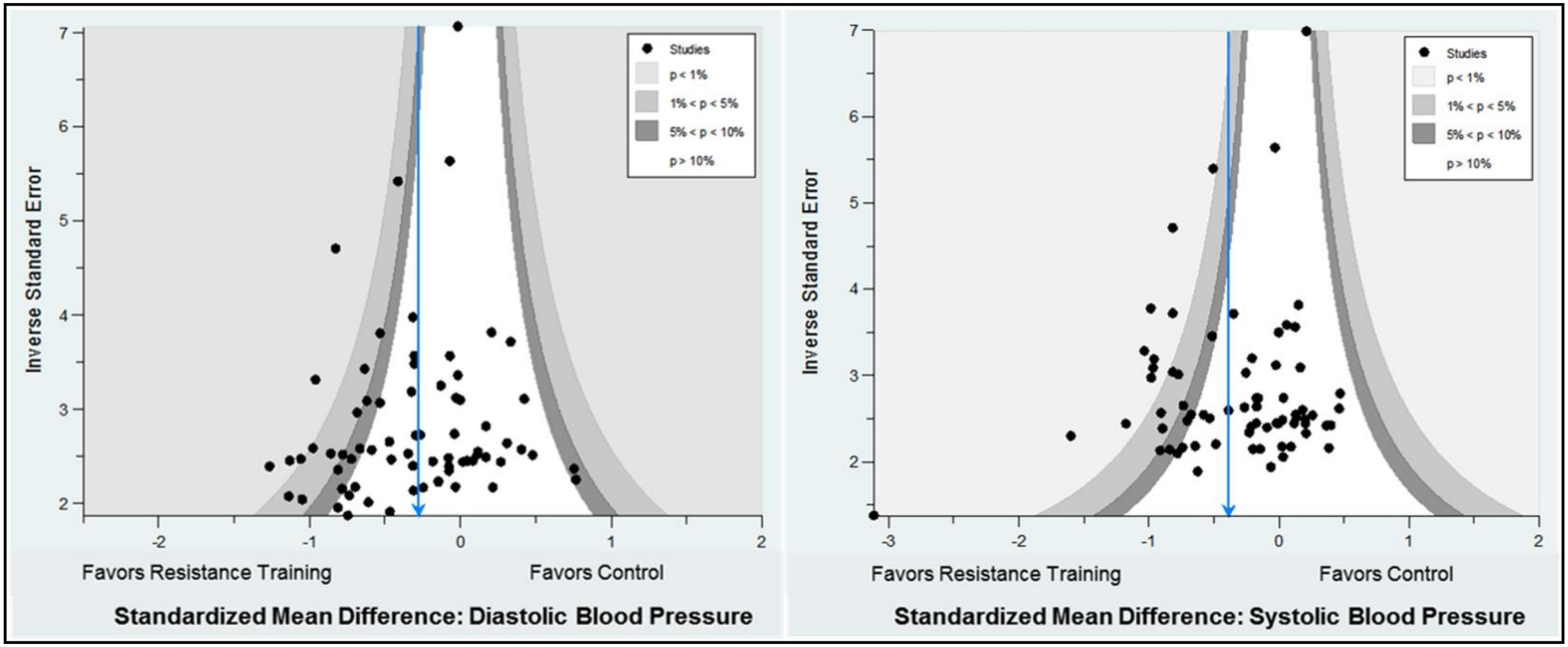


Figure S3. Contour-enhanced funnel plots: A visual representation of the effect size distribution for the antihypertensive effects of dynamic resistance training versus non-exercise control. Weighted mean effect size values ($\hat{d}_+$) are negative when resistance training reduced blood pressure to a greater extent than control. The blue line and arrowhead indicates the overall mean effect size.

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