

## Summary of intervention trials on health effects of participation in specific sports

| Study and location                   | Study design | Population group                                                | Intervention                                                                                                                                                                                          | Intervention group(s)                      | Control group(s)                 | Adherence to the intervention                                               | Outcome variables:<br>[1] Cardiovascular function at rest<br>[2] Cardio-respiratory fitness<br>[3] Body composition<br>[4] Metabolic fitness<br>[5] Muscular fitness<br>[6] Bone strength<br>[7] Physical performance                                                                                                                                                                                                                                                                                                                                                                          | Data analysis method                                                                                                                                                                                                                                                                                                  | Adverse events                                  | Summary results:<br>[1] Statistically significant pre-post changes within the intervention group (shown only in the absence of significant between-group delta changes)<br>[2] Statistically significant differences between the pre-post changes in the intervention group(s) and the control group                                                      |
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| Andersen et al. [27] (2010), Denmark | CCT          | 47 untrained women ( $36.5 \pm 8.2$ years old)                  | Football (small-sided), 16 weeks, 1 hour/session, twice/week, 82% HR <sub>max</sub><br><br>Running, 16 weeks, 1 hour/session, twice/week, 82% HR <sub>max</sub>                                       | Football, $n=19$<br><br>Running, $n=18$    | $n=10$                           | Football 1.8 sessions/week<br><br>Running 1.8 sessions/week                 | [1] HR (bpm), MAP (mmHg), Echocardiographic variables: left ventricular diameter end-diastole and end-systole (mm), septum thickness end-diastole (mm), posterior wall thickness end-diastole (mm), left ventricular volume biplane (ml), left ventricular ejection fraction (%), $E$ (m/s), $E'$ declaration time (ms), $A$ (ms), $E/A$ ratio, IVRT <sub>global</sub> (ms), RVDD (mm), TAPSE, : $E'$ (cm/s), $A'$ (cm/s), $S'$ (cm/s), $E/E'$ , $S'$ colorTDI (cm/s), $TT_{index}$ (mm), IVRT <sub>averaged</sub> (ms)<br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ) | Within-group changes by students two-tailed paired t-test. Between-group differences at baseline and intervention induced changes by ANOVA.                                                                                                                                                                           | No reported                                     | [2] Football: left ventricular volume biplane, TAPSE, $S'$ , $S'$ colorTDI, $TT_{index}$ increased; $A$ , IVRT <sub>global</sub> , IVRT <sub>averaged</sub> decreased<br><br>[2] Running: left ventricular volume biplane, $E/A$ ratio, TAPSE, $S'$ colorTDI, $TT_{index}$ increased; $A$ , IVRT <sub>global</sub> and IVRT <sub>averaged</sub> decreased |
| Andersen et al. [28] (2014), Denmark | CCT          | 26 untrained men ( $68.2 \pm 3.2$ years old, range 63-74 years) | Football (small-sided), 16 weeks, 3x15 min/session for weeks 1-12 and 4x15 min/session for weeks 13-16, two session/week; 84% HR <sub>max</sub>                                                       | Football, $n=9$ , 68.0 $\pm$ 4.0 years old | $n=8$ , $67.4 \pm 2.7$ years old | 1.6 $\pm$ 0.1 sessions/week = 77.1 $\pm$ 2.4 % adherence to intervention    | [2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ); peak VE (L/min), RER, HR (bpm), blood lactate (mmol/L), power output (W); time-to-exhaustion (s). Same variables at 4.5 km/h walking and 7.0 km/h jogging.<br><br>[5] CMJ (cm)<br><br>[7] Yo-Yo IE1 performance, sit-to-stand (repetitions)                                                                                                                                                                                                                                                                                   | One-way ANOVA for group differences before intervention, one-way repeated measures ANOVA for HR and blood variables during training, two-way repeated measures ANOVA for between- and within group changes.                                                                                                           | No reported                                     | [1] Football: VO <sub>2max</sub> , time-to-exhaustion, Yo-Yo IE1 performance, sit-to stand increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in football vs. control reported.                                                                                                                   |
| Andersen et al. [29] (2016), Denmark | CCT          | 27 untrained men ( $68.1 \pm 2.1$ years old, range 63-74 years) | Football (small-sided), 52 weeks, two sessions/week for weeks 1-16 and 3 sessions/week for weeks 17-52, 3x15 min/session for weeks 1-12 and 4x15 min/session for weeks 13-52, 80% HR <sub>max</sub> . | Football, $n=9$ , 68.0 $\pm$ 4.0 years old | $n=8$ , $67.4 \pm 2.7$ years old | $\sim 1.7 \pm 0.3$ sessions/ week<br>$\sim 57$ % attendance to intervention | [3] BW (kg), BMI, FFM (kg), upper body FFM (kg), leg FFM (kg), FM (kg), leg FM (kg), upper body FM (kg), % BF (%), android % f (%), gynoid % f (%), A/G ratio<br><br>[4] fasting glucose (mM), 2 h OGTT glucose (mM), OGTT AUC (nM/2 hours), HbA1c (mM), fasting insulin ( $\mu$ M), HOMA-IR, total chol (mM), HDL chol (mM), LDL chol (mM), triglyc (mM), total chol/HDL chol ratio, LDL chol/HDL chol ratio                                                                                                                                                                                  | Within and between group changes after 52 weeks analysed by two-way repeated measures ANOVA.<br><br>Shapiro-Wilk (normality of the distribution) and Levene's (homogeneity of variance) tests were calculated before statistical evaluation for all experimental data to justify the application of ANOVA statistics. | One achilles tendon tear in the football group. | [2] Football: BW, FFM, leg FFM decreased                                                                                                                                                                                                                                                                                                                  |

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|                                   |     |                                             |                                                                                                                                                                                                                                                                                                              |                                                            |                                             |                                                                                        | [5] CS ( $\mu\text{mol/g dw/min}$ ), HAD ( $\mu\text{mol/g dw/min}$ ), PFK ( $\mu\text{mol/g dw/min}$ ), capillary density ( $\text{cap mm}^2$ ), capillary density C:F ratio, type I area ( $\mu\text{m}^2$ ), type IIA area ( $\mu\text{m}^2$ ), type IIX ( $\mu\text{m}^2$ ), mean fibre area ( $\mu\text{m}^2$ ), % type I, % type IIA, % type IIX                                                                   |                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Aras & Akalan [30] (2015), Turkey | CCT | 19 (10 women) untrained university students | Rock climbing, 8 weeks, 3 sessions/week, 60 min/session, 70% HR <sub>max</sub> . Training took place on 12-meter-high indoor artificial climbing wall using the top-rope technique. Before the intervention subjects were trained to have basic holding and stepping skills in four familiarization sessions | Rock climbing, $n=9$ (4 women), $21.11 \pm 2.31$ years old | $n=10$ (6 women), $21.9 \pm 1.66$ years old | No information                                                                         | [2] VO <sub>2max</sub> ( $\text{mL kg}^{-1} \text{min}^{-1}$ ), HR <sub>max</sub> (bpm), test duration (min), peak work load (W)<br><br>[3] BW (kg), FFM (kg), FM (kg), % fat, BMI<br><br>[5] peak torque (N-M), average torque (N-M), peak torque/body weight (%); average power on 60°/s and 120°/s angular velocities (W) for right elbow flexion, left elbow flexion, right elbow extension and left elbow extension | Paired sample t-test for parametric distribution variables and Wilcoxon's test for non-parametric variables.                                                                     | No reported | [1] Rock climbing: VO <sub>2max</sub> , test duration, left elbow flexion 60°/s peak torque/kg, left elbow extension 60°/s average torque and peak torque/kg, right elbow flexion 120°/s peak torque, average torque, peak torque/kg and average power, right elbow extension 120°/s peak torque and peak torque/kg, left elbow extension 60°/s peak torque/kg increased; FM, % fat decreased<br><br>[2] No statistically significant differences between the changes in the outcome variables in rock climbing vs. control reported. |
| Aras & Ewert [31] (2016), Turkey  | CCT | 19 (10 women) untrained university students | Sport rock climbing, 8 weeks, 1 hour/session, 3 sessions/week, 70% HR <sub>max</sub> . Climbing was done on 12-m climbing wall using top-rope technique                                                                                                                                                      | Sport rock climbing, $n=9$ , $21.1 \pm 2.3$ years old      | $n=10$ , $21.9 \pm 1.7$ years old           | Distance of climbing approximately 300 m in the first week and 900 m in the last week. | [1] HR (bpm)<br><br>[2] VO <sub>2max</sub> ( $\text{mL kg}^{-1} \text{min}^{-1}$ ), HR <sub>max</sub> (bpm)<br><br>[3] BW (kg), BH (cm)                                                                                                                                                                                                                                                                                  | Mean differences determined with Paired Sample t-Test and Wilcoxon Test. Independent-sample t-Test and Mann-Whitney U Test for pre-control and experimental groups' differences. | No reported | [1] Sport rock climbing: VO <sub>2max</sub> increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in sport rock climbing vs. control reported.                                                                                                                                                                                                                                                                                                                                   |
| Aslan et al. [32] (2019), Turkey  | CCT | 20 healthy untrained men (20-27 years old)  | Recreational football (small-sided), 8 weeks, one session/week, 1 hour/session, 80% HR <sub>max</sub>                                                                                                                                                                                                        | Football, $n=10$ , $22.1 \pm 1.8$ years old                | $n=10$ , $23.4 \pm 1.6$ years old           | No information.                                                                        | [1] HR <sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg).<br><br>[2] VO <sub>2peak</sub> ( $\text{mL kg}^{-1} \text{min}^{-1}$ ) (from 20-m shuttle run), anaerobic power (W, W/kg) (Wingate test)<br><br>[3] BW (kg), BMI, % fat, FFM (kg), sum of eight skinfolds (mm)<br><br>[5] peak running distance (m), squat jump (cm), CMJ (cm), isokinetic leg strength: eccentric and concentric peak                             | Within group changes analyzed with separate 2 x 2 (groups x time) mixed repeated-measures ANOVA.                                                                                 | No reported | [1] Football: % fat, sum of eight skinfolds total and arm decreased; VO <sub>2peak</sub> , peak running distance, CMJ, squat jump, quadriceps concentric peak torque and peak torque to body weight, hamstring eccentric peak torque and peak torque to body weight increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in football vs. control reported.                                                                                                                      |

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|                                     |     |                                      |                                                                                                                                                                            |                                     |      |                                                                 | torque and peak torque to body weight                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                        |                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Bangsbo et al. [33] (2010), Denmark | CCT | 65 untrained women (19-47 years old) | Football (small-sided) 16 weeks, 1 hour/session, two session/week, 83% HR <sub>max</sub><br><br>Running 16 weeks, 1 hour/session, two sessions/week, 82% HR <sub>max</sub> | Football, n=21<br><br>Running, n=18 | n=14 | Football, 1.80 sessions/week<br><br>Running, 1.85 sessions/week | <p>[2] Time to exhaustion in treadmill test (s), VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), VO<sub>2max</sub> (L/min); HR (bpm), blood lactate (mmol/L) during 6,5 km/h walking and 8,0 km/h running</p> <p>[3] FFM legs (kg)</p> <p>[5] Muscle metabolites and enzyme activities: glycogen content (mmol/kg dw), CS activity (μmol/kg dw/min), HAD activity (μmol/g dw/min), capillaries (#/fiber), capillaries (#/mm<sup>2</sup>), ST fiber size (μm<sup>2</sup>), FT (μm<sup>2</sup>), FTa fiber size (μm<sup>2</sup>), FTx fiber size (μm<sup>2</sup>), mean fiber size (μm<sup>2</sup>), fiber type distribution (% ST fibers, % FTa fibers, % FTx fibers)</p> <p>[7] 30-m sprint time (s), peak running speed (km/h), Yo-Yo IE2 performance (m)</p> | Pre- and post-test data were evaluated by one-way ANOVA on repeated measures. When significant time-effect was detected, data were subsequently analyzed by Student-Newman-Keuls post-hoc test. Between group differences in delta values were evaluated by ANOVA (results not shown). | 4 injuries (2 in football, 2 in running) | <p>[1] Football: FFM legs, 30-m sprint, peak running speed, time-to-exhaustion, VO<sub>2max</sub>, Yo-Yo IE2 increased; HR and blood lactate during 6.5 km/h walking and 8.0 km/h running decreased</p> <p>[1] Running: FFM legs, time-to-exhaustion, VO<sub>2max</sub>, Yo-Yo IE2 increased; HR and blood lactate during 6.5 km/h walking and 8.0 km/h running decreased</p> <p>[2] No statistically significant differences between the changes in the outcome variables in football and running vs. control reported.</p> |

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| Barene et al. [36] (2014a), Norway                                                                       | CCT (cluster randomized) | 107 female hospital employees (45.8 ± 9.3 years old, range 25-63 years) | Football (small-sided), 12 weeks, 1 hour/session, 2-3 sessions/week, 78.3 ± 4.4% HR <sub>max</sub> . Training was done in matches in a gymnastics hall and/or in a sports hall | Football, n=37, 44.1 ± 8.7 years old | n=35, 47.4 ± 9.5 years old | 2.4 ± 0.5 sessions/week                                                  | <p>[1] SBP (mmHg), DBP (mmHg)</p> <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), VO<sub>2max</sub> (L min<sup>-1</sup>), peak power output (W), time to exhaustion (s), RER, VE<sub>peak</sub> (L min<sup>-1</sup>), HR<sub>submax</sub> (bpm)</p> <p>[3] BW (kg), total FM (kg), % fat, FM trunk (kg), FM lower limb (kg)</p> <p>[4] Leptin (μg L<sup>-1</sup>)</p> <p>[6] BMD (g/cm<sup>2</sup>) and BMC (g) total body, lumbar spine, lower limb, osteocalcin (μg L<sup>-1</sup>)</p>                                                                                                                                                                                                                                                                                                                   | ANCOVA analyses with intention-to-treat principle, missing values substituted with carried-forward or carried-backward measures variables. | No reported | [2] Football: VO <sub>2max</sub> , peak power output, osteocalcin increased; BW, HR <sub>submax</sub> , % fat, total FM, FM lower limb decreased                  |
| Barene et al. [35] (2014b), Norway (this is the same trial as Barene et al 2016 with different outcomes) | CCT (cluster randomized) | 107 female hospital employees (45.8 ± 9.3 years old, range 25-63 years) | Football (small-sided), 40 weeks, 1 hour/session, 2.35 sessions/week for weeks 1-12 and 0.87 sessions/week for weeks 13-40, 78% HR <sub>max</sub>                              | Football, n=37, 44.1 ± 8.7 years old | n=35, 47.4 ± 9.5 years old | 2.35 sessions/week for weeks 1-12 and 0.87 sessions/week for weeks 13-40 | <p>[1] SBP (mmHg), DBP (mmHg)</p> <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), VO<sub>2max</sub> (L min<sup>-1</sup>), peak power output (W), time to exhaustion (s), RER<sub>peak</sub>, VE<sub>peak</sub> (L min<sup>-1</sup>), HR<sub>submax</sub> (bpm)</p> <p>[3] BW (kg), BMI, % fat, % fat trunk, % fat lower limb, total FM, FM trunk (kg), FM lower limb (kg)</p> <p>[4] S-glucose (mmol L<sup>-1</sup>), total S-chol (mmol L<sup>-1</sup>), HDL-chol (mmol L<sup>-1</sup>), LDL-chol (mmol L<sup>-1</sup>), triglyc (mmol L<sup>-1</sup>), leptin (μg L<sup>-1</sup>)</p> <p>[6] total body BMD (g/cm<sup>2</sup>), lumbar spine BMD (g/cm<sup>2</sup>), lower limb BMD (g/cm<sup>2</sup>), total body BMC (g), lumbar spine BMC (g), lower limb BMC (g), osteocalcin (μg L<sup>-1</sup>)</p> | ANCOVA analyses with intention-to-treat principle, missing values substituted with carried-forward or carried-backward measures variables. | No reported | [2] Football: % fat, % fat lower limb, total FM, FM trunk, FM lower limb, leptin decreased; osteocalcin, lower limb BMD, total body BMC, lower limb BMC increased |

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| Barene et al. [34] (2016), Norway     | CCT (cluster randomized) | 107 female hospital employees (45.8 ± 9.3 years old, range 25-63 years)                                  | Football (small-sided), 9 months, 1 hour/session, 2-3 sessions/week for months 1-3 and one session/week for months 4-9, 78% HR <sub>max</sub> . | Football, <i>n</i> =37, 44.1±8.7 years old                | <i>n</i> =35, 47.4 ± 9.5 years old                 | No information                                                                                             | [5] trunk flexion (N), trunk extension (N), neck extension (N), leg extension (N), trunk lean mass (g), lower limb lean mass (G), maximal jump height (cm)<br><br>[7] sit-and-reach (cm), postural sway: X extension (mm), Y extension (mm), X speed (mm/s), Y speed (mm/s), velocity moment (mm <sup>2</sup> /s)                                                                                                                                                                         | ANCOVA analyses with intention-to-treat principle, missing values substituted with carried-forward or carried-backward measures variables.                                                                                                                                                     | No reported                                | [2] Football: neck extension increased                                                                                                                                                                           |
| Beato et al. [37] (2017), Italy       | RCT                      | 24 middle-aged men (44.5±4.7 years old.)                                                                 | Futsal (recreational), 12 weeks, 1 hour/session, 1 session/week                                                                                 | Futsal, <i>n</i> =10, 42.9±4 years old                    | <i>n</i> =14, 45.6 ± 4.8 years old                 | Adherence 83%                                                                                              | [1] HR <sub>rest</sub> (bpm), DBP (mmHg), SBP (mmHg), MAP (mmHg)<br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ), maximal aerobic speed (km/h)<br><br>[3] BW (kg), BMI (kg m <sup>-2</sup> ), % fat<br><br>[4] total chol, HDL-chol, LDL-chol, triglyc (all mmol L <sup>-1</sup> )                                                                                                                                                                                 | Two-way analysis of variance (ANCOVA) for repeated measures. Tukey test used for post hoc analysis.                                                                                                                                                                                            | 2 injuries (achilles and hamstring tendon) | [2] Futsal: VO <sub>2max</sub> , maximal aerobic speed increased; SBP, MAP decreased                                                                                                                             |
| Blond et al. [38] (2019), Denmark     | RCT                      | 130 physically inactive healthy women (53%) and men with overweight or class 1 obesity (20-45 years old) | Cycling (commuting), 6 months, 4.4 sessions/week, 42 min/session, 5.3 METs, 59% HR <sub>reserve</sub>                                           | Cycling, <i>n</i> =34 women (54%) and men, 35±7 years old | <i>n</i> =18 women (50%) and men, 35 ± 7 years old | Compliance to cycling 88% (25 <sup>th</sup> centile 80%, 75 <sup>th</sup> centile 97%) of prescribed days. | [2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> )<br><br>[3] BW (kg), FFM (kg), FM (kg), WC (cm), intra-abdominal adipose tissue FM (g)<br><br>[4] metabolic clearance rate of glucose (mL/min/pmol <sub>insulin</sub> /L), fasting glucose (mmol/L), fasting insulin (mmol/L), HOMA-IR, clamp glucose disposal rate (mg/min), clamp glucose (90-120 min) (mmol/L), clamp insulin (90-120min) (μmol/L), AUC glucose, mixed meal challenge, AUC insulin mixed meal challenge | Analyses of repeated measures performed using baseline constrained mixed linear models with the means as a function of time by group-by-time interaction. Intervention effects were estimated by restricted maximum likelihood inference with comparisons of response profiles between groups. | 2 injuries                                 | [2] Cycling: VO <sub>2max</sub> , metabolic clearance rate of glucose increased; BW, FM, intra-abdominal adipose tissue, clamp insulin (90-120 min) decreased                                                    |
| Carrasco & Vaquero [39] (2012), Spain | CCT                      | 93 postmenopausal women (50-70 years old).                                                               | Swimming, 12 months, 2 sessions/week, 45 min/session, 12-15 RPE                                                                                 | Swimming, <i>n</i> =29, 58.8±6.5 years old                | <i>n</i> =30, 56.6 ± 6.4 years old                 | ≥95% attendance                                                                                            | [3] BMI<br><br>[5] mean prone force (N), mean power (Nm/sec), mean work (Nm), countermovement jump (m), isometric trunk flexion (N), isometric knee extension (N)                                                                                                                                                                                                                                                                                                                         | MANOVA and Bonferroni pot-hoc test used for the comparison of the pre- and post-means. Paired-samples T test for the impact of the training programmes.                                                                                                                                        | No reported                                | [1] Swimming: BMI, isometric trunk flexion, isometric knee extension decreased<br><br>[2] No statistically significant differences between the changes in the outcome variables in swimming vs. control reported |

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| Celik et al. [40] (2013), Turkey    | RCT | 44 healthy sedentary male students (18-25 years old)                                                                                                                   | Running (treadmill, 1.5% incline), 12-weeks, 3 session/week, 40 min/session, 60-70% HR <sub>reserve</sub> .<br>Swimming (front crawl and kicking drills), 12-weeks, 3 session/week, 40 min/session, 60-70% HR <sub>reserve</sub> | Running, $n=11$ , 20.7 $\pm$ 1.3 years old<br><br>Swimming, $n=11$ , 22.8 $\pm$ 1.9 years old | $n=11$ , 22.6 $\pm$ 2.1 years old                                            | Participation rate was 86% for running and 90% for swimming | [2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ),<br><br>[3] BW (kg), BMI<br><br>[5] quadriceps peak torque to body weight (Nm/kgbw), serum cartilage oligomeric matrix protein levels before, immediately and 0.5 h and after 30 min walking exercise                | Intervention effects analyzed with 4 x 2 (groups x time) mixed repeated-measures ANOVA. Bonferroni confidence interval adjustment used for multiple comparisons.                                                                                                    | 1 health problem in swimming | [1] Running: BMI decreased; VO <sub>2max</sub> increased<br><br>[1] Swimming: BMI decreased, VO <sub>2max</sub> , quadriceps peak torque increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in running and swimming vs. control reported. |
| Cho & Roh [41] (2019), Korea        | CCT | 37 women (65 years or older)                                                                                                                                           | Teakwondo, 16 weeks, 5 sessions/week, 60 min/session, 50-80 % HR <sub>max</sub>                                                                                                                                                  | Teakwondo, $n=19$ , 68.89 $\pm$ 4.16 years old                                                | $n=18$ , 69.00 $\pm$ 4.41 years old                                          | Participation rate 87.5%                                    | [1] systolic flow velocity, diastolic flow velocity, mean flow velocity, pulsatility index of middle cerebral arteries<br><br>[2] 2 min step test<br><br>[5] 30 s chair stand test, 30 s arm curl test<br><br>[7] chair sit-and-reach test, back scratch test, 2.44 m up-and-go test | Two-way repeated measures of ANOVA to assess time and group differences. T-tests to identify statistical significance of interactions.                                                                                                                              | No reported                  | [2] Teakwondo: 30 s stair stand, chair sit-and-reach, 2 min step test increased                                                                                                                                                                                                                   |
| Ciaccioni et al. [42] (2019), Italy | CCT | 30 older adults (69.7 $\pm$ 4.2 years old)                                                                                                                             | Judo, 4-months, 2 sessions/week, 60 min/session                                                                                                                                                                                  | Judo, $n=16$ : 8 women 67.6 $\pm$ 3.7 years and 8 men 71.0 $\pm$ 3.5 years old                | $n=14$ : 5 women 70.1 $\pm$ 5.0 years old and 9 men 70.2 $\pm$ 4.0 years old | 84% attended >75% of all sessions                           | [3] BW (kg), BMI, hip circum. (cm), waist circum. (cm)<br><br>[5] handgrip (kg), chair stand (n), arm curl (n).<br><br>[7] sit-and-reach (cm), back-scratch (cm), fear of falls (falls efficacy scale, FES)                                                                          | Intervention effects analyzed by repeated measures 2 x 2 x 2 (gender) multivariate analysis of variance (MANOVA) and subsequent analysis of variance (ANOVA). In case of significant time x group interactions Bonferroni correction used for multiple comparisons. | No reported                  | [2] Judo: waist circum. decreased; sit-and-reach, back scratch, chair stand, arm curl increased                                                                                                                                                                                                   |
| Connolly et al. [44] (2014), UK     | CCT | 66 premenopausal women (20-45 years old), non-smokers, not pregnant, not on medication, encouraged not to change their dietary intake, maintain their normal lifestyle | Football (small-sided) 16 weeks, 2 sessions/week, 13.5 min/session, 85 $\pm$ 5% HR <sub>max</sub> during first week of training and 83 $\pm$ 3% HR <sub>max</sub> during last week of training.                                  | Football, $n=13$ , 39 $\pm$ 6 years old                                                       | $n=14$ , 40 $\pm$ 5 years old                                                | No information                                              | [3] BW (kg), BMI, % fat, FM and FFM (kg) for arms, legs, trunk, android, gynoid, total<br><br>[5] Muscle phosphorus metabolism before exercise test PCr (mmol/L) and PCr/Pi, test time (s), end exercise test PCr (%)                                                                | Repeated measures ANOVA with group as between-subject factor and time as repeated factor used for intervention effects. One-way ANOVA for between-group differences at baseline and intervention-induced within-group changes.                                      | No reported                  | [2] Football: FM trunk, FM android, % fat decreased; PCr % increased                                                                                                                                                                                                                              |

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| Connolly et al. [43] (2016), Faroe Island & UK | RCT | 62 sedentary premenopausal women with mild to moderate hypertension (35-49 years old) | Swimming, 15 weeks:<br>High-intensity low-volume (HIT): 3 sessions/week, 15-25 min/session, $86 \pm 3\%$ HR <sub>max</sub><br>Low-intensity high-volume (LIT), 3 sessions/week, 1 hour/session, $73 \pm 3\%$ HR <sub>max</sub> | Swimming HIT, $n=21$ , $44 \pm 5$ years old<br>Swimming LIT, $n=21$ , $46 \pm 4$ years old                                    | $n=20$ , $45 \pm 4$ years old                                                                                   | HIT: $2.9 \pm 0.1$ sessions/week<br>LIT: $2.9 \pm 0.1$ sessions/week                                                                 | [4] Insulin sensitivity and blood glucose from fasting blood sample: oral glucose tolerance test (OGTT) sampling at 0, 30, 60 and 120 min; serum glucose (mmol L <sup>-1</sup> ), plasma insulin (μIU mL <sup>-1</sup> ), insulin sensitivity (HOMA IR), plasma s-ICAM-1 and s-VCAM-1 (ng mL <sup>-1</sup> ), and area under curve (AUC) for OGTT.                                                                                                                       | Two-factor mixed ANOVA design with between factor (group) and repeated factor (condition, pre vs. post) for all variables except 2-h OGTT. OGTT analyzed with three-factor mixed ANOVA using group (HIT vs. LIT vs. Con); condition (pre vs. post) and time (0, 30, 60, 120 minutes). Bonferroni post hoc t tests used when interaction or main effects detected. | 1 aquatic phobia in LIT swimming                                                                   | [2] Swimming HIT: plasma insulin, HOMA-IR, plasma s-VCAM-1 decreased                                                                                                                                                                     |
| de Geus et al. [46] (2008), Belgium            | CCT | 92 untrained women and men (33-58 years old)                                          | Cycling to work, 1 year, $3.4 \pm 1.4$ times/ week, 66min/day, $5.7 \pm 1.2$ METs                                                                                                                                              | Cycling to work, $n=65$ (35 women), $43 \pm 5$ years old                                                                      | $n=15$ (8 women), $49 \pm 7$ years old                                                                          | 38% and 34% of participants cycled $\geq 3$ per week to work during the first and second 6-mo period of intervention, respectively   | [1] SBP (mmHg), DBP (mmHg)<br><br>[2] VO <sub>2max</sub> (mL min <sup>-1</sup> and mL min <sup>-1</sup> kg <sup>-1</sup> ), HR <sub>max</sub> (bpm), P <sub>max</sub> , P <sub>max</sub> /kg in maximal incremental cycle ergometer test<br><br>[3] BW (kg), BMI<br><br>[4] total chol, HDL-chol, LDL-chol, VLDL-chol, triglyc, C-reactive protein (all mg dL <sup>-1</sup> )                                                                                            | Two-way analysis of covariance (ANCOVA) with repeated measures (time). Bonferroni post hoc test when significant change over time between groups found.                                                                                                                                                                                                           | No reported                                                                                        | [2] Cycling: P <sub>max</sub> , VO <sub>2peak</sub> mL min <sup>-1</sup> kg <sup>-1</sup> increased                                                                                                                                      |
| de Geus et al. [45] (2009), Belgium            | CCT | 92 untrained women and men (33-58 years old)                                          | Cycling to work, 1 year, $3.4 \pm 1.4$ times/ week, 66 min/day, $5.7 \pm 1.2$ METs                                                                                                                                             | Cycling to work, $n=65$ (35 women), $43 \pm 5$ years old                                                                      | $n=15$ (8 women), $49 \pm 7$ years old                                                                          | 38% and 34% of participants cycled $\geq 3$ x per week to work during the first and second 6-mo period of intervention, respectively | [2] VO <sub>2max</sub> (mL min <sup>-1</sup> and mL min <sup>-1</sup> kg <sup>-1</sup> ), HR <sub>max</sub> (bpm), P <sub>max</sub> , P <sub>max</sub> /kg in maximal incremental cycle ergometer test                                                                                                                                                                                                                                                                   | Two-way analysis of covariance (ANCOVA) with repeated measures (time). Bonferroni post hoc if significant change over time between groups found.                                                                                                                                                                                                                  | No reported                                                                                        | [2] Cycling: P <sub>max</sub> , VO <sub>2peak</sub> mL min <sup>-1</sup> kg <sup>-1</sup> increased                                                                                                                                      |
| Dela et al. [47] (2011), Austria               | CCT | 60 healthy older adults (60-75 years old)                                             | Alpine skiing, 12 weeks, 2-3 days/ week, 3.5 hour/day, $73 \pm 9\%$ HR <sub>max</sub>                                                                                                                                          | Alpine skiing, $n=27$ $66.6 \pm 0.4$ years old, (13 females, $67.2 \pm 2.9$ years old, and 14 males $67.7 \pm 2.8$ years old) | $n=20$ , $67.0 \pm 1.0$ years old (10 females, $66.3 \pm 3.7$ years old, and 10 males $68.2 \pm 5.0$ years old) | From total of 32 sessions subjects participated on average $28.5 \pm 2.6 = 89\%$                                                     | [1] SBP (mmHg), DBP (mmHg), E-selectin, ICAM-1, VCAM-1 (all ng mL <sup>-1</sup> ) hs-CRP (mg L <sup>-1</sup> ), endothelin-1 (pg mL <sup>-1</sup> ),<br><br>[3] BW (kg), BMI, % fat<br><br>[4] fasting blood glucose, total chol, HDL-chol, LDL-chol, triglyc, (all mmol L <sup>-1</sup> ), plasma free fatty acids (FFA), glycerol and homocysteine (all μmol L <sup>-1</sup> ), plasma insulin and C-peptide (both pmol L <sup>-1</sup> ), HOMA2 (insulin resistance). | Two-way analysis of variance (ANOVA) for repeated measures with two factors (intervention vs. control and pre- vs. post-training) for the between-group changes.                                                                                                                                                                                                  | 2 knee pain (with earlier injuries), 2 fractures while falling, 1 knee pain without specific cause | [1] Alpine skiing: % fat, total chol, LDL-chol, glycerol, insulin, HOMA2, homocysteine decreased<br><br>[2] No statistically significant differences between the changes in the outcome variables in alpine skiing vs. control reported. |

|                                      |     |                                                                                                                                  |                                                                                                                                                                                |                                                                  |                                                         |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                            |                                               |                                                                                                                                                                                                                                                                              |
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| Fristrup et al. [48] (2020), Denmark | RCT | 95 men and women (young adults), no participation in regular exercise activity for the past two years (except commuting cycling) | Handball (small-sided, recreational), 12 weeks, 1.8 sessions/week, 40 min/session, 83±8% HR <sub>max</sub>                                                                     | Handball, <i>n</i> =28 (14 men and 14 women), 24.1±2.6 years old | <i>n</i> =26, 12 men and 14 women, 24.8 ± 3.1 years old | Attendance on average 1.8 ± 0.3 (=60%) sessions/week                               | <p>[3] % fat, FFM (kg), FFM legs (kg)</p> <p>[5] CMJ (cm), CMJ P<sub>peak</sub> (W/kg), dynamic (MVC, Nm) and isometric knee extensor strength (MVIC, Nm), muscle fiber type distribution (%) and cross-sectional area (μm<sup>2</sup>), fiber area percentage distribution (%), capillaries (capillaries/fiber and capillaries/mm<sup>2</sup>)</p> <p>[6] total body BMC (kg), BMC legs (kg), total body BMD (g/cm<sup>2</sup>), total hip BDM (g/cm<sup>2</sup>), total body T-score and total hip T-score.</p> <p>[7] sway area (cm<sup>2</sup>), sway length (mm)</p>   | Two-way repeated-measures analysis of variance (ANOVA) with repeated measurements. Dependent sample t testing for within-group changes.                                                    | No reported                                   | [2] Handball: % fat decreased; FFM, total body BMC, BMC legs, total hip BDM, total hip T-score increased                                                                                                                                                                     |
| Helge et al. [50] (2010), Denmark    | CCT | 65 premenopausal women (36.5±7.7 years old), non-smokers, no medication                                                          | <p>Football (small-sided), 14 weeks, 2 sessions/week, 1 hour/session, 83% HR<sub>max</sub></p> <p>Running, 14 weeks, 2 sessions/week, 1 hour/session, 82% HR<sub>max</sub></p> | <p>Football, <i>n</i>=12</p> <p>Running, <i>n</i>=16</p>         | <i>n</i> =9                                             | <p>Football 1.8 ± 0.3 sessions/week</p> <p>Running 1.9 ± 0.3 sessions/week</p>     | <p>[3] leg MM, leg FFM leg lean mass (kg)</p> <p>[5] CMJ jump height (m), CMJ peak power (W/kg), isokinetic muscle strength (Nm/kg): Q con 30°/s, Q con 240°/sec, H con 30°/sec, H con 240°/sec: left lower leg MCSA (mm<sup>3</sup>), right lower leg MCSA (mm<sup>3</sup>)</p> <p>[6] volumetric BMD of distal tibia (mg/cm<sup>3</sup>); total left and right, trabecular left and right, cortical + subcortical left and right; areal BMD (g/cm<sup>2</sup>): left + right leg, total body</p> <p>[7] postural balance (# of falls): left leg, right leg, both legs</p> | Between-group differences in pre-post delta values tested by one-way ANOVA and when main effects found between group differences they were analyzed by Student-Newman-Keuls post hoc test. | 2 injuries in football, 2 injuries in running | <p>[2] Football: volumetric BMD of total left and right distal tibia and trabecular left distal tibia, MCSA of both lower legs, CMJ jump height, CMJ peak power increased; postural balance of both legs decreased</p> <p>[2] Running: MCSA of both lower legs increased</p> |
| Helge et al. [49] (2014), Denmark    | CCT | 32 men (68.2±3.2, 65-75 years old), non-smoking healthy without chronic diseases                                                 | Football (small-sided), 12 months, 2-3 sessions/week, 45 min/session during weeks 0-12 and 60 min/session during weeks 13-52, 82% (64-90%) HR <sub>max</sub> .                 | Football, <i>n</i> =9, 68.0±4.0 years old                        | <i>n</i> =8, 67.4 ± 2.7 years old                       | Attendance 66% ± 4 %, average number of training session/week 1.7 ± 0.3 (1.2-2.2). | [6] BMD (g/cm <sup>2</sup> ): whole body, femoral neck right and left, femoral shaft right and left, total proximal femur right and left; bone turnover markers: osteocalcin (μg/L), procollagen type-1 amino-terminal propeptide (pg/L) (PINP), carboxy-terminal type-1 collagen crosslinks (μg/L) (CTX-1)                                                                                                                                                                                                                                                                 | Two-way repeated measures ANOVA with Hom-Sidak post-hoc testing for within- and between-group changes.                                                                                     | 1 achilles tendon rupture                     | <p>[1] Football: Osteocalcin, PINP, CTX-1, BMD right and left femoral neck, right femoral shaft, right and left total proximal femur increased</p> <p>[2] No statistically significant differences between the pre-post changes in football vs. control reported.</p>        |

|                                       |     |                                                                                                                                    |                                                                              |                                            |                                    |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                  |                                                                                                                                                                                                                                                                                           |
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| Hornstrup et al. [53] (2018), Denmark | CCT | 45 women (20-30 years old) no familiar diseases or medication, and no smoking or regular physical activity during the past 2 years | Handball, 12 weeks, 2 sessions/week, 40 min/session, 85±6% HR <sub>max</sub> | Handball, <i>n</i> =14, 23.9±2.4 years old | <i>n</i> =14, 24.1 ± 3.2 years old | Attendance 1.7 ± 0.3 sessions/week | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg), HbA1C (%),</p> <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), time to exhaustion (s), HR at 80% submax (bpm)</p> <p>[3] BW (kg), % fat, total MM (kg) and FM (kg)</p> <p>[4] total chol (mmol/L), HDL-chol (mmol/L), LDL-chol (mmol/L), triglyc (mmol/L)</p> <p>[6] proximal femur BMD (g/cm<sup>3</sup>), carboxy terminal type-1 collagen crosslinks (pg/L), procollagen type-1 amino-terminal propeptide (pg/L), osteocalcin (pg/L)</p> <p>[7] Yo-Yo IE1 test performance (m)</p>                                                                | Two-way repeated measures ANOVA for within- and between-group changes with Tukey's honest significant post hoc tests. | 1 ankle injury   | [2] Handball: Yo-Yo IE1 test performance, time to exhaustion, total MM, proximal femur BMD, osteocalcin increased                                                                                                                                                                         |
| Hornstrup et al. [51] (2019), Denmark | CCT | 50 men (20-30 years old), no medication or regular physical activity during the previous 2 years                                   | Handball, 12 weeks, 3 sessions/week, 40 min/session, 84±4% HR <sub>max</sub> | Handball, <i>n</i> =14, 24.2±2.8 years old | <i>n</i> =12, 25.8 ± 2.8 years old | Attendance 1.9 ± 0.3 sessions/week | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg)</p> <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), time to exhaustion (s)</p> <p>[3] FM (kg), MM (kg), % fat</p> <p>[4] total chol (mmol/L), HDL-chol (mmol/L), LDL-chol (mmol/L), triglyc (mmol/L)</p> <p>[5] Muscle oxidative activity: citrate synthase (μg/l), 3-hydroxacyl-CoA dehydrogenase (μg/l)</p> <p>[6] proximal femur BMD (g/cm<sup>3</sup>), total BMC (kg), osteocalcin (μg/L), procollagen type-1 amino-terminal propeptide (μg/L), carboxy-terminal type-1 collagen crosslinks (μg/L)</p> <p>[7] Yo-Yo IE1 test performance (m)</p> | Two-way repeated measures ANOVA for within- and between-group changes with Tukey's honest significant post hoc tests. | 2 ankle injuries | [2] Handball: VO <sub>2max</sub> , Yo-Yo IE1 test performance, time to exhaustion, muscle citrate synthase, osteocalcin, procollagen type-1 amino-terminal propeptide, carboxy-terminal type-1 collagen crosslinks, total BMC, proximal femur BMD increased; triglyc, FM, fat % decreased |

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| Hornstrup et al. [52] (2020), Denmark | CCT | 40 women (35-50 years old, premenopausal), overweight: BMI handball group = 28.4±4.7, control group = 29.8±5.5 | Handball, 16 weeks, 2 sessions/week, 40 min/session, 84±5 % HR <sub>max</sub>                                                                                                                                                                                                   | Handball, n=13, 46.3±2.9 years old                                                                                                         | n=9, 41.8 ± 4.6 years old  | Attendance 1.7 ± 0.3 sessions/week                                                                                  | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), HbA1C (%), echocardiography: 17 measures</p> <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>)</p> <p>[3] BW (kg), BMI, MM (kg), % fat, FM (kg), android FM (kg), gynoid FM (kg)</p> <p>[4] total chol (mmol/L), HDL-chol (mmol/L), LDL-chol (mmol/L), triglyc (mmol/L)</p> <p>[7] Yo-Yo IE1 test performance (m)</p>      | Linear mixed model for the pre-post changes between the groups. Between group outcomes reported as estimated mean difference with 95% confidence intervals of the pre-post change score. | 1 broken finger | [2] Handball: VO <sub>2max</sub> , Yo-Yo IE1 test performance, mitral A-Wave velocity increased; % fat, FM, android FM decreased                                                                                                                                                                                                                                       |
| Jakobsen et al. [54] (2011), Denmark  | CCT | 43 healthy untrained men (21-45 years old)                                                                     | Football (recreational, small-sided) 12 weeks, 2.3 sessions/ week, 55 min/session<br>Running (continuous) 12 weeks, 2.0 sessions/week, 55 min/session, 80% HR <sub>max</sub><br>Running (interval), 12 weeks, 2.5 sessions/week, 5 x 2 min/session, >90% of HR <sub>max</sub> . | Football n=12, 30.3±5.8 years old<br><br>Running (continuous), n=12, 29.0±5.2 years old<br><br>Running (interval), n=9, 36.9±5.0 years old | n=10, 30.4 ± 7.5 years old | Football 2.3 session/week<br><br>Running (continuous) 2.5 sessions/week<br><br>Running (interval) 2.0 sessions/week | <p>[7] Flamingo balance test (# of falls/1 min) (left leg, right leg. mean), 11 measures of postural sway on force platform</p>                                                                                                                                                                                                                                                                 | Within-group pre-post differences evaluated by repeated measures ANOVA. Between-group pre-post differences (post minus pre-values in % of pre-values) tested by ANOVA.                   | No reported     | <p>[2] Football: medio-later sway velocity, medio-lateral sway area, medio-lateral sway acceleration, Flamingo test falls decreased</p> <p>[2] Running: Flamingo test falls decreased</p> <p>[2] Running: medio-lateral sway velocity, medio-lateral sway area, Flamingo test falls decreased</p>                                                                      |
| Jakobsen et al. [55] (2012), Denmark  | CCT | 49 healthy untrained men (21-45 years old)                                                                     | Football (recreational, small-sided) 12 weeks, 2.3 sessions/ week, 55 min/session<br>Running (continuous) 12 weeks, 2.0 sessions/week, 55 min/session, 80% HR <sub>max</sub><br>Running (interval), 12 weeks, 2.5 sessions/week, 5 x 2 min/session, >90% of HR <sub>max</sub>   | Football n=15, 30.3±5.8 years old<br><br>Running (continuous), n=9, 29.0±5.2 years old<br><br>Running (interval), n=7, 36.9±5.0 years old  | n=10, 30.4 ± 7.5 years old | No information.                                                                                                     | <p>[3] BW (kg), % fat, FFM legs (kg)</p> <p>[5] CMJ jump: jump height (m), time (ms), force (N/kg), velocity (ms), power (W/kg), jumping stiffness (N/m), muscle fiber distribution: fiber area (μm<sup>2</sup>) and % area; neuromuscular activity (EMG data): quadriceps, hamstring, and plantar flexors: mean activity during concentric phase (μV) and maximal rate of EMG rise (μV/s).</p> | Between group differences in delta values (pre vs post values) tested using one-way analysis of variance (ANOVA).                                                                        | No reported     | <p>[1] Football: % fat and muscle fiber type IIX % area decreased; FFM legs, mean fiber area of quadriceps muscle and quadriceps EMG amplitude increased</p> <p>[1] Running continuous: % fat decreased</p> <p>[2] No statistically significant differences between the pre-post changes in football, continuous running or interval running vs. control reported.</p> |
| Khadije et al. [56] (2018), Iran      | CCT | 24 healthy non-athletic obese young women                                                                      | Futsal (recreational), 6 weeks, 30 min/session, 3                                                                                                                                                                                                                               | Futsal (n=14)                                                                                                                              | n=10                       | No information.                                                                                                     | [3] BW (kg), % fat, waist circumf. (cm), hip circumf. (cm), BMI                                                                                                                                                                                                                                                                                                                                 | Within- and between-group changes and the between-group                                                                                                                                  | No reported     | [1] Futsal: BW, % fat, waist and hip circumf., BMI decreased                                                                                                                                                                                                                                                                                                           |

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|                                                 |     | (19-23 years old, %BF $\geq$ 30)                                      | times/week, 60-75% HR <sub>reserve</sub>                                                                                                                                      |                                                                                               |                                   |                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | differences of intervention effects analyzed by T-test.                                                                                 |                                               | [2] No statistically significant differences between the pre-post changes in futsal vs. control reported.                                                                                                                                 |
| Knoepfli-Lenzin et al. [57] (2010), Switzerland | CCT | 57 untrained men (20-45 years old, with mild hypertension)            | Football (small-sided), 12 weeks, 1 hour/session, 3 sessions/week, 79.9% HR <sub>max</sub><br><br>Running, 12 weeks, 1 hour/session, 3 sessions/week, 79.4% HR <sub>max</sub> | Football, $n=15$ , 37 $\pm$ 4 years old<br><br>Running, $n=15$ , 36 $\pm$ 5 years old         | $n=17$ , 38 $\pm$ 5 years old     | Football 2.4 $\pm$ 0.2 sessions/week<br><br>Running 2.5 $\pm$ 0.3 sessions/week | [1] SBP (mmHg), DBP (mmHg), HR <sub>supine</sub> (bpm), HR <sub>standing</sub> (bpm); heart rate variability: pNN50 <sub>supine</sub> (%), pNN50 <sub>standing</sub> (%), SD I <sub>supine</sub> , SD I <sub>standing</sub><br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> and L min <sup>-1</sup> ), V <sub>max</sub> (km/h),<br><br>[3] BM (kg), WC (cm), WHR, FM (kg), % fat, FFM (kg)<br><br>[4] total chol (mmol/L), HDL-chol (mmol/L), LDL-chol (mmol/L), total chol/HDL-chol ratio<br><br>[7] Yo-Yo IE2 test performance (m) | Univariate general linear ANOVA used for between-group differences over time and Bonferroni's post hoc test for between groups effects. | 2 injuries in football                        | [2] Football: FM, % fat decreased; VO <sub>2max</sub> , V <sub>max</sub> increased<br><br>[2] Running: VO <sub>2max</sub> , V <sub>max</sub> , Yo-Yo IE2 increased                                                                        |
| Krustrup et al. [61] (2009), Denmark            | CCT | 36 untrained men (20-43 years old)                                    | Football (small-sided), 12 weeks, 1 hour/session 2-3 sessions/week, 82% HR <sub>max</sub><br><br>Running, 12 weeks, 1 hour/session 2-3 sessions/week, 82% HR <sub>max</sub>   | Football, $n=12$ , 30 $\pm$ 2 SEM years old<br><br>Running, $n=10$ , 31 $\pm$ 2 SEM years old | $n=10$ , 30 $\pm$ 2 SEM years old | Football 2.3 sessions/week<br><br>Running 2.5 sessions/week                     | [1] HR <sub>rest</sub> , SBP (mmHg), DBP (mmHg)<br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ), VE <sub>max</sub> (L/min), HR at 9.5 km/h (bpm), blood lactate at 9.5 km/h (mmol/L), RER at 9.5 km/h<br><br>[3] BW (kg), BMI, FM (kg); % fat, legs BF, upper body BF, FFM (kg)<br><br>[4] total chol (mmol/L), HDL-chol (mmol/L), LDL-chol (mmol/L)<br><br>[5] muscle capillaries (n) of vastus lateralis<br><br>[6] total, legs, upper body; bone mass (kg); total, legs, upper body BMD (g/cm <sup>2</sup> )                    | Repeated measures ANOVA used for within-group changes with Neuman-Keuls post hoc test. One-way ANOVA for between-group changes.         | 1 injury in football, 2 injuries in running   | [2] Football: VO <sub>2max</sub> , VE <sub>max</sub> , FFM, muscle capillaries increased; SBP, DBP, HR <sub>rest</sub> , % fat decreased<br><br>[2] Running: blood lactate and RER at 9.5 km/h running, DBP, HR <sub>rest</sub> decreased |
| Krustrup et al. [60] (2010a), Denmark           | CCT | 65 pre-menopausal women (36 $\pm$ 2 SEM years old, range 19-47 years) | Football (small-sided), 16 weeks, 1 hour/session, twice/week, 83% HR <sub>max</sub><br><br>Running, 16 weeks, 1 hour/session, twice/week, 82% HR <sub>max</sub>               | Football, $n=21$ , 37 $\pm$ 2 SEM years old<br><br>Running, $n=17$ , 37 $\pm$ 1 SEM years old | $n=14$ , 33 $\pm$ 2 SEM years old | Football 1.8 sessions/week<br><br>Running 1.85 sessions/week                    | [1] HR <sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg); vascular function: reactive hyperemia index (RHI), augmentation index (AI)<br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> ), VE <sub>max</sub> (L/min)                                                                                                                                                                                                                                                                                                            | Repeated measures ANOVA used for within-group changes with Neuman-Keuls post hoc test, and one-way ANOVA for between-group changes.     | 2 injuries in football, 2 injuries in running | [2] Football: VO <sub>2max</sub> , VE <sub>max</sub> , FFM increased; HR <sub>rest</sub> , FM, AI decreased<br><br>[2] Running: VO <sub>2max</sub> , FFM increased; HR <sub>rest</sub> decreased                                          |

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|                                       |     |                                           |                                                                                                                                                                                                              |                                                                                                                                           |                                  |                                                                    | <p>[3] BW (kg), BMI, % fat, total, android, gynoid; FM (kg) total, legs, upper body; FFM (kg)</p> <p>[4] total Chol, HDL-chol, LDL-chol (all mmol/L), LDL-chol/HDL-chol ratio, triglyc, resting blood glucose, two-hour OGTT blood glucose, fasting plasma insulin (<math>\mu\text{mol/L}</math>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Krustrup et al. [59] (2010b), Denmark | CCT | 28 pre-menopausal women (19-47 years old) | <p>Football (small-sided), 16 months, 1 hour/session, twice/week, 81% <math>\text{HR}_{\text{max}}</math></p> <p>Running, 16 months, 1 hour/session, twice/week, 82% <math>\text{HR}_{\text{max}}</math></p> | <p>Football, <math>n=7</math>, 40 <math>\pm</math> 3 SEM years old</p> <p>Running, <math>n=8</math>, <math>\pm</math> 2 SEM years old</p> | $n=7$ , 38 $\pm$ 4 SEM years old | <p>Football 1.7 sessions/week</p> <p>Running 1,7 sessions/week</p> | <p>[1] <math>\text{HR}_{\text{rest}}</math> (bpm), SBP (mmHg), DBP (mmHg); echocardiographic variables: LVDD (mm), LVSD (mm), Lvvolume (mL), LVEF (%), IVSd (mm), LVPWd (mm), E (m/s), A (m/s), E/A, E' (m/s), S' (m/s), A' (m/s), IVRTglobal (ms), S' TDlcolor (m/s), Ttindex (mm), RVDD (mL), TAPSE (mm)</p> <p>[2] <math>\text{VO}_{2\text{max}}</math> (<math>\text{mL kg}^{-1} \text{ min}^{-1}</math>), <math>\text{VE}_{\text{max}}</math> (L/min), ), blood lactate at 6.5 km/h (mmol/L), blood lactate at 8.0 km/h (mmol/L), )</p> <p>[3] BW (kg), BMI, % fat, FM (kg), android FM (%), gynoid FM (%), FFM (kg), leg FFM (kg)</p> <p>[4] fasting blood glucose ABL (mmol/L), fasting blood glucose YSI (mmol/L)</p> <p>[6] total BMD (<math>\text{g/cm}^2</math>), legs BMD (<math>\text{g/cm}^2</math>), total BMC (kg), legs BMC (kg)</p> <p>[7] Yo-Yo IE2 test performance (m), 30 m sprint test (s), treadmill test time (s), balance right leg (# falls/1 min), balance left leg (# falls/1 min), balance mean of both legs (# falls/1 min), stopping time (ms), distance moved (cm)</p> | Repeated measures ANOVA used for within-group changes. ANOVA with Student-Newman-Keuls post hoc test for differences in between-group changes. | No reported | <p>[2] Football: FFM, LVDD, E/A reatio, TAPSE, <math>\text{VO}_{2\text{max}}</math>, treadmill test time, Yo-Yo IE2 test performance increased; gynoid fat %, distance moved, stopping time, # of falls in balance test, <math>\text{HR}_{\text{rest}}</math>, blood lactate at 6.5 and 8 km/h, 30 m sprint time decreased</p> <p>[2] Running: <math>\text{VO}_{2\text{max}}</math>, Yo-Yo IE2 test performance, treadmill test time increased; <math>\text{HR}_{\text{rest}}</math>, # of falls in balance test, blood lactate at 8 km/h, sprint time decreased</p> |
| Krustrup et al. [58] (2010c), Denmark | CCT | 38 untrained men (20-43 years old)        | Football (small-sided), 12 weeks, 1 h/session, 2-3 sessions/week, 82% $\text{HR}_{\text{max}}$                                                                                                               | <p>Football, <math>n=12</math></p> <p>Running, <math>n=10</math></p>                                                                      | $n=10$                           | <p>Football 2.3 sessions/week</p> <p>Running 2.5 sessions/week</p> | <p>[1] <math>\text{HR}_{\text{max}}</math> (bpm), <math>\text{VO}_{2\text{max}}</math> (<math>\text{L min}^{-1}</math>), RER at 6.5, 8.0, 9.5 and 11.0 km/h, RERmax</p> <p>[5] Muscle metabolites, enzyme activity and fiber types: glycogen content</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Two-way ANOVA used for within-group pre- post differences. ANOVA for between-group pre-post changes with Tukey's post hoc test.                | No reported | <p>[2] Football: <math>\text{VO}_{2\text{max}}</math>, Yo-Yo IE2 test performance, mean muscle fiber size, CS activity increased</p> <p>[2] Running: <math>\text{VO}_{2\text{max}}</math> increased</p>                                                                                                                                                                                                                                                                                                                                                              |

|                                      |                             |                                                                  |                                                                                                          |                                                          |                                             |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                        |                                         |                                                                                                                                           |
|--------------------------------------|-----------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|                                      |                             |                                                                  | Running, 12 weeks, 1 h/session, 2-3 times/week, 82% HR <sub>max</sub>                                    |                                                          |                                             |                                                                                              | (mmol/kg d.w.), CP content (mmol/kg d.w.), CS activity (μmol/g d.w./min), HAD activity (μmol/g d.w./min), capillaries (#/fiber), capillaries (#/mm <sup>2</sup> ), ST fiber size (μm <sup>2</sup> ), FTa fiber size (μm <sup>2</sup> ), FTx fiber size (μm <sup>2</sup> ), mean fiber size (μm <sup>2</sup> ), fiber type distribution (% ST fibers, % Fta fibers, % FTx fibers)<br><br>[7] Yo-Yo IE2 test performance (m) |                                                                                                                                                                                        |                                         |                                                                                                                                           |
| Krustrup et al. [62] (2017), Denmark | CCT                         | 41 pre-menopausal women with moderate hypertension (MAP>95 mmHg) | Football (recreational, small-sided), 1 year, 1 hour/session, 2.5 ± 0.4 session/week                     | Football, n=21, 45 ± 6 years old                         | n=20, 45 ± 4 years old                      | 2.5 ± 0.4 sessions/week (range 1.8-3.5), totaling 128 ± 29 sessions (range 91-182 sessions). | [1] HR <sub>rest</sub> (bpm), HR <sub>submax</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg)<br><br>[3] BW (kg), FFM (kg), % fat<br><br>[4] total chol, HDL-chol, LDL-chol, triglyc, blood glucose (all mmol L <sup>-1</sup> ), CRP, vitamin D<br><br>[6] BMC (kg), BMD (g/cm <sup>2</sup> )<br><br>[7] Yo-Yo intermittent endurance test level 1 (Yo-Yo IE1) (m), 20-m sprint test (s)                                    | Differences in baseline values and pre-to-post effects were tested using analysis of variance, and between group differences tested using pre-to-post delta values in a one-way ANOVA. | 1 achilles tendon rupture               | [2] Football: triglyc, 20-m sprint time SBP, DBP, MAP, BW, FFM, relative HR after 2 min of Yo-Yo IE1 run decreased; BMC and BMD increased |
| Lauber et al. [63] (2011), Austria   | CCT                         | 23 men (12) and women (11), (66±1 years of age)                  | Alpine skiing, 12 weeks, 2-3 days/week, 3h ± 14 min/day                                                  | Alpine skiing, n=13, 7 men and 6 women, 66.8±2 years old | n=10, 5 men and 5 women, 67.5 ± 4 years old | On average 28.5 ± 2.6 days of skiing                                                         | [5] maximum isometric strength (N/kg)<br><br>[7] postural sway (cm)                                                                                                                                                                                                                                                                                                                                                        | Repeated measures ANOVA used with Bonferroni corrected paired test                                                                                                                     | 2 fractures while falling during skiing | [2] Alpine skiing: maximum isometric strength increased                                                                                   |
| Lee & Oh [64] (2015), Korea          | Non-randomized intervention | 24 women, 40-60 years                                            | Swimming, 12 weeks, 40 min/session, 3 times/week, 60-70 %HRR for weeks 1-6 and 70-80 %HRR for weeks 7-12 | Swimming, n=12, 45.54 ± 1.65 years                       | n=12, 47.25 ± 2.03 years                    | No information                                                                               | [3] % fat, FFM (kg)<br><br>[4] tot Chol, HDL-chol, LDL-chol, triglyc (all mg/dL)<br><br>[5] grip strength, sit-ups<br><br>[7] long-distance running, upper body bending                                                                                                                                                                                                                                                    | Paired t-test for within-group changes, and independent t-test for between-group differences                                                                                           | No reported                             | [2] Swimming: % fat, tot Chol, triglyc decreased; upper body bending increased                                                            |
| Leung et al. [65] (2020), Hong Kong  | CCT                         | 78 men (13) and women (49) (≥60 years old)                       | Volleyball (gas ball), 15 weeks, two sessions/week, 90 min/session,                                      | Volleyball, n= 17 (50% women), 72.00±1.52 years old      | n=22 (78% women), 75.05 ±1,56 years old     | Attendance 80%                                                                               | [2] aerobic endurance (2-min step test)<br><br>[3] BMI<br><br>[5] chair stand, arm curl, hand grip<br><br>[7] chair sit and reach, back scratch, 8 foot up-and-go                                                                                                                                                                                                                                                          | Analyzes were done by MANCOVA for the group effects with ANCOVA for statistically significant differences in MANCOVA.                                                                  | No reported                             | [2] Volleyball: aerobic endurance, chair stand, 8-foot agility, hand grip improved                                                        |
| Liu & Liu [66] (2021),               | RCT                         | 51 female college students                                       | Running (high intensity), 12                                                                             | Running (high intensity), n=15                           | n=20                                        | No information                                                                               | [6] femoral BMD, lumbar spine BMD, ulna and radius                                                                                                                                                                                                                                                                                                                                                                         | Single-factor ANOVA                                                                                                                                                                    | No reported                             | [1] Femoral BMD, alkaline phosphate and osteocalcin increased in both running                                                             |

|                                       |     |                                         |                                                                                                                                                                                    |                                                |                                    |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                |               |                                                                                                                                                                                 |
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| China                                 |     |                                         | months, 60 min/session, 3 session/week, 70-80 % HR <sub>max</sub> ,<br><br>Running (medium-small intensity), 12 months, 60 min/session, 3 sessions/week, 50-60 % HR <sub>max</sub> | Running (medium-small intensity), <i>n</i> =16 |                                    |                                        | BMD, alkaline phosphatase, osteocalcin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                |               | groups, lumbar spine BMD increased in high intensity running group                                                                                                              |
| Mendham et al. [68] (2014), Australia | CCT | 33 untrained men (48.6 ± 6.6 years old) | Rugby (small-sided), 8 weeks, 3 sessions/week, 40 min/session, 85.2% ± 0.3 HR <sub>max</sub> , 12.4 ± 0.1 RPE                                                                      | Rugby, <i>n</i> =10, 46.8±6.6 years old        | <i>n</i> =11, 49.2 ± 7.0 years old | 91% ± 2% adherence to the intervention | [2] VO <sub>2</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> and L min <sup>-1</sup> ) at 80% HR <sub>max</sub> , workload (Watts)<br><br>[3] BMI, WHR, FM (kg), % fat, FFM (kg)<br><br>[4] CRP (mg L <sup>-1</sup> ), IL-6, TNFα, IL-1β, IL-10, IL-1ra (all pg mL <sup>-1</sup> ), Leptin and Adiponectin (all ng mL <sup>-1</sup> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Two-way repeated measures ANOVA and Turkey's adjustment between conditions at each time point were used for the analyses.                                                      | 1 knee injury | [2] Rugby: VO <sub>2</sub> at 80% HR <sub>max</sub> , workload, FFM increased; FM, % fat, CRP, IL-6, Leptin decreased                                                           |
| Mendham et al. [67] (2015), Australia | RCT | 33 untrained men (48.6 ± 6.6 years old) | Rugby (small-sided), 8 weeks, 3 sessions/week, 40 min/session, 85.2% ± 0.3 HR <sub>max</sub> , 12.4 ± 0.1 RPE                                                                      | Rugby, <i>n</i> =10, 46.8±6.6 years old        | <i>n</i> =11, 49.2 ± 7.0 years old | 91% ± 2% adherence to the intervention | [2] VO <sub>2</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> and L min <sup>-1</sup> ) at 80% HR <sub>max</sub> , workload (Watts), test duration (min)<br><br>[3] BW (kg), BMI, waist girth (cm), WHR, FM (kg), % fat, FFM (kg), intra-abdominal FM (kg)<br><br>[4] fasting insulin (μIU mL <sup>-1</sup> ), glucose (mmol L <sup>-1</sup> ), glucose AUC (mmol L <sup>-1</sup> (120 min) <sup>-1</sup> ), insulin AUC (μIU mL <sup>-1</sup> (120 min) <sup>-1</sup> ), Matsuda ISI (μIU mL <sup>-1</sup> , mg mL <sup>-1</sup> ), HOMA-IR (μIU mL <sup>-1</sup> , mmol L <sup>-1</sup> ), HbA1c (%A1c), total Chol, HDL-cholesterol, triglyc (all mmol L <sup>-1</sup> ), total Chol/ HDL-cholesterol<br><br>[5] leg press (kg), chest press (kg), skeletal muscle protein content: PGC-1α, Tfam, mitochondrial complex I-V, MEF2A, SIRT-1, P53, GLUT4, AKT, α-tubulin, NRF1, NRF2 | Two-way repeated measures ANOVA used for the analyses of the intervention effects with paired sample t-tests when a significant condition x time interaction effect was found. | 1 knee injury | [2] Rugby: FM, % fat, glucose AUC, insulin AUC, HbA1c decreased; FFM, VO <sub>2</sub> at 80 % HR <sub>max</sub> , workload, test duration, leg press, and Matsuda ISI increased |

|                                                     |     |                                                                                              |                                                                                                                                                                                                                                                                  |                                                                                                          |                                        |                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                          |                           |                                                                                                                                                                                                                                           |
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| Meyers [69] (2006), USA                             | CCT | 35 women (23.6 ± 2.5 years old)                                                              | Equitation (four natural equine gaits: walk, trot, extended trot, canter), 14 weeks, 40 min/session, 5 sessions/week, 68% HR <sub>max</sub>                                                                                                                      | Equitation, <i>n</i> =15, 24.8 ± 2.0 SEM years old                                                       | <i>n</i> =10, 21.9 ± 1.0 SEM years old | No information                                                      | <p>[2] VO<sub>2max</sub> (mL kg<sup>-1</sup> min<sup>-1</sup>), VE<sub>max</sub> (L min<sup>-1</sup>), HR<sub>max</sub> (bpm), RER<sub>max</sub>, MAP<sub>max</sub> (mmHg), rate pressure product<sub>max</sub>; Wingate anaerobic power test: peak power (W, W/kg), mean power (W, W/kg), total work output (J, J/kg), fatigue index (%)</p> <p>[3] BW (kg), % fat, FFM (kg),</p> <p>[4] iron (µg/dL), triglyc (mg/dL), total chol (mg/dL), HDL-chol (mg/dL), LDL-chol (mg/dL), total chol/HDL-chol ratio</p> <p>[5] curl-ups (#/min), reverse sit-ups (#/min), push-ups (#/min), hand grip (kg)</p> | MANOVA used to compare pre- and post-training responses. Least squared means procedure used for between-group differences. Univariate analyses when significant main effects were found. | No reported               | <p>[1] Equitation: anaerobic mean power and total work output increased; fatigue index decreased</p> <p>[2] No statistically significant differences between the changes in the outcome variables in equitation vs. control reported.</p> |
| Milanović et al. [71] (2015a), Serbia               | CCT | 69 untrained man (20 to 40 years old)                                                        | Football (small-sided), 12 weeks, 3 session/week, 60 min/session, 80% HR <sub>max</sub> (65-100%). Running, 12 weeks, 3 sessions/week, 60 min/session, 80% HR <sub>max</sub> (65-85%)                                                                            | Football, <i>n</i> =20, 34±4 years old<br><br>Running, <i>n</i> =21, 32±4 years old                      | <i>n</i> =23, 30 ± 3 years old         | Football 87 %, running 83 %                                         | <p>[2] VO<sub>2max</sub> (L min<sup>-1</sup> and mL kg<sup>-1</sup> min<sup>-1</sup>), HR<sub>max</sub> (bpm), VE<sub>max</sub> (L min<sup>-1</sup>)</p> <p>[3] BW (kg), BMI, FFM (kg)</p> <p>[5] squat jump (cm), CMJ with arm swing (cm)</p> <p>[7] sit-and-reach (cm)</p>                                                                                                                                                                                                                                                                                                                          | Two-factor (group x time) univariate ANOVA used for intervention effects with Bonferroni post-hoc test for between-group differences.                                                    | 1 minor injury in running | <p>[2] Football: BW, BMI decreased; FFM, VO<sub>2max</sub>, VE<sub>max</sub>, squat jump, CMJ with arm swing, sit-and-reach increased</p> <p>[2] Running: BW, BMI decreased; FFM, VO<sub>2max</sub>, increased</p>                        |
| Milanović et al. [70] (2015b), Serbia               | CCT | 69 untrained man (20 to 40 years old)                                                        | Football (small-sided), 12 weeks, 3 session/week, 60 min/session, 80% HR <sub>max</sub> (65-100%). Running, 12 weeks, 3 sessions/week, 60 min/session, 80% HR <sub>max</sub> (65-85%)                                                                            | Football, <i>n</i> =20, 34±4 years old<br><br>Running, <i>n</i> =21, 32±4 years old                      | <i>n</i> =23, 30 ± 3 years old         | Football 87 %, running 83 %                                         | <p>[3] BW (kg), BMI, FFM (kg), % fat, BF (kg), TBW (L)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Two-factor (group x time) univariate ANOVA used for intervention effects.                                                                                                                | 1 minor injury in running | <p>[2] Football: BW, BMI, % fat, BF decreased</p> <p>[2] Running: BW, BMI, % fat, BF decreased</p>                                                                                                                                        |
| Mohr et al. [74] (2014a), England and Faroe Islands | CCT | 62 premenopausal women (35-50 years old) with mild hypertension (MAP 96-110 mmHg) and BMI>25 | Swimming (high intensity intermittent, HIT), 15 weeks, 2.9 sessions/week, 6-10 x 30 s/session, mean %HR <sub>max</sub> 85.5±1.1, peak %HR <sub>max</sub> 95.3±1.1<br>Swimming (moderate-intensity continuous, MOD): 15 weeks, 2.9 sessions/week, 1 hour/session, | Swimming (HIT), <i>n</i> =21, 44±2 SEM years old<br><br>Swimming (MOD), <i>n</i> =20, 46±2 SEM years old | <i>n</i> =20, 45 ± 2 SEM years old     | <p>HIT: 2.6-3.3 sessions/week</p> <p>MOD: 2.5-3.3 sessions/week</p> | <p>[1] SBP (mmHg), DBP (mmHg), HR<sub>rest</sub> (bpm), MAP (mmHg)</p> <p>[2] % HR<sub>max</sub> in Yo-Yo IE1</p> <p>[3] BF (kg), FFM (kg), hip- and waist-circumference (cm), BW (kg).</p> <p>[4] LDL-chol, HDL-chol, triglyc (all mmol L<sup>-1</sup>)</p> <p>[7] Yo-Yo IE1 test performance (m); endurance swimming performance (s) and</p>                                                                                                                                                                                                                                                        | Two-way factor mixed ANOVA and one-way ANOVA with repeated measures used for within- and between-group changes and Newman-Keuls post hoc test when significant interaction was found.    | No reported               | <p>[2] Swimming: SBP, BF, % HR<sub>max</sub> in Yo-Yo IE1 test decreased in HIT and MOD swimming; FFM, Yo-Yo IE1 test performance increased in HIT and MOD swimming</p>                                                                   |

|                                                              |     |                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                |                                                              |                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                       |                                                      |                                                                                                         |
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|                                                              |     |                                                                                                                            | mean %HR <sub>max</sub><br>75±0.9, peak<br>%HR <sub>max</sub> 79.1±1.0                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                                                              |                                                                                                                         | repeated swimming sprint test<br>(s) in swimming groups only                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                       |                                                      |                                                                                                         |
| Mohr et al. [73]<br>(2014b),<br>England and<br>Faroe Islands | CCT | 41 premenopausal<br>women (35-50<br>years old) with<br>mild-to-moderate<br>hypertension<br>(MAP>100<br>mmHg) and<br>BMI>25 | Football (small-<br>sided), 15 weeks,<br>3.0±0.1 (range<br>2.7-3.5)<br>sessions/week, 1<br>hour, 80.5±1.1<br>%HR <sub>max</sub> (1 <sup>st</sup> week<br>of training) and<br>98.9±1.4 %HR <sub>max</sub><br>(last week of<br>training)                                                                                                                                                                                                                                                    | Football, <i>n</i> =21,<br>45±3 SE years old                                                                                                                   | <i>n</i> =20, 43±3 SE<br>years old                           | Football:45±1<br>training<br>sessions                                                                                   | [1] SBP, DBP, MAP (all<br>mmHg), HR <sub>rest</sub> ,<br><br>[2] % HR <sub>max</sub> in Yo-Yo IE 1<br><br>[3] % fat, FM (kg), FFM (kg),<br>BW (kg)<br><br>[4] total chol, HDL-chol, LDL-<br>chol, triglyc (all mmol/L)<br><br>[7] Yo-Yo IE 1 test<br>performance (m)                                                                                                                                                                                                                                  | ANOVA used for within-<br>and between-group pre-<br>post differences. One-way<br>ANOVA used for<br>between-group pre-post<br>delta differences.       | 1<br>achilles<br>tendon<br>rupture<br>in<br>football | [2] Football: SBP, DBP, FM, total chol,<br>triglyc decreased; Yo-Yo IE 1 test<br>performance increased  |
| Mohr et al. [72]<br>(2015), Faroe<br>Islands                 | CCT | 83 premenopausal<br>women (45±6<br>years old) with<br>mild hypertension<br>(MAP 96-110<br>mmHg) and BMI<br>>25             | Football (small-<br>sided), 15 weeks,<br>3 (2.7-3.5)<br>session/week, 1<br>hour/session<br><br>Swimming (high<br>intensity<br>intermittent, HIT),<br>15 weeks, 2.9<br>sessions/week, 6-<br>10 x 30 s/session,<br>mean %HR <sub>max</sub><br>85.5±1.1, peak<br>%HR <sub>max</sub> 95.3±1.1<br><br>Swimming<br>(moderate-<br>intensity<br>continuous,<br>MOD): 15 weeks,<br>2.9 sessions/week,<br>1 hour/session,<br>mean %HR <sub>max</sub><br>75±0.9, peak<br>%HR <sub>max</sub> 79.1±1.0 | Football, <i>n</i> =21,<br>45±14 years old<br><br>Swimming (HIT),<br><i>n</i> =21, 44±9 years<br>old<br><br>Swimming<br>(MOD), <i>n</i> =21,<br>46±9 years old | <i>n</i> =20, 45 ± 9 years<br>old                            | Football: 45 ± 5<br>sessions<br><br>HIT: 44 ± 5<br>sessions<br><br>MOD: 45 ± 5<br>sessions                              | [6] Bone formation markers:<br>total bone mineral content<br>(BMC), left leg BMC, right leg<br>BMC, pelvis BMC, arm BMC,<br>and head BMC (all g); total<br>BMD, left leg BMD, right leg<br>BMD, pelvis BMD, arm BMD,<br>head BMD, femoral shaft<br>BMD and trochanter BMD (all<br>g cm <sup>-2</sup> ). Bone turnover<br>markers: C-terminal<br>telopeptide (CTX1) (ng mL <sup>-1</sup> ),<br>procollagen type I N<br>propeptide (PINP) (ng mL <sup>-1</sup> ),<br>osteocalcin (ng mL <sup>-1</sup> ) | ANOVA with Newman-<br>Keuls post hoc test used<br>for within group changes<br>and for between group<br>pre-to-post delta values.                      | 1<br>achilles<br>tendon<br>rupture<br>in<br>football | [2] Football: total leg BMC, femoral<br>shaft BMD, trochanter BMD,<br>osteocalcin, PINP, CTX1 increased |
| Møller et al.<br>[75] (2011),<br>Denmark                     | RCT | 56 middle-aged<br>men (≥18 years<br>old)                                                                                   | Cycling<br>(commuter), 8<br>weeks, daily (5<br>days/week?),<br>approx. 40<br>min/day                                                                                                                                                                                                                                                                                                                                                                                                      | Cycling, <i>n</i> =19, 13<br>men and 6<br>women, 44.4±8<br>years old                                                                                           | <i>n</i> =23, 16 men and<br>7 women, 46.0 ±<br>9.1 years old | Four men from<br>the IG failed to<br>reach the<br>required<br>minimum of a<br>total of 200 km<br>of commuter<br>cycling | [1] SBP (mmHg), DBP<br>(mmHg)<br><br>[2] VO <sub>2max</sub> (mL kg <sup>-1</sup> min <sup>-1</sup> )<br><br>[3] BMI, BF from 6 skinfolds<br>(mm)                                                                                                                                                                                                                                                                                                                                                      | Multivariate analysis of<br>co-variance used to<br>compare the between-<br>group changes with<br>adjustment for baseline<br>measures, age and gender. | No<br>reported                                       | [2] Cycling: BF decreased; VO <sub>2max</sub><br>increased                                              |

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| Mühlbauer et al. [76] (2012), Switzerland | CCT | 28 young adults                            | Climbing (indoor), 8 weeks, 2 sessions/week, 1 hour/session, top-rope climbing with progressively increasing difficulty | Climbing, $n=14$ , 11 women, 3 men, 29.3±3 years old            | $n=14$ , 10 women, 4 men, 28.9 ± 2.2 years old     | On average 89.4 %                                                   | [5] maximal isometric core strength (sagittal and coronal plane) (N), handgrip strength (N)<br><br>[7] trunk mobility (sagittal and coronal plane) (°)                                                                                                                                                                                                                                                                   | Repeated measure ANOVA with time and group interaction used for intervention effects with Bonferroni adjustment for multiple comparisons.                           | No reported                                    | [2] Climbing: core strength, handgrip strength, trunk mobility increased                                                                                                                                                                           |
| Müller et al. [77] (2011), Austria        | CCT | 47 men and women (60-76 years old)         | Alpine skiing, 12 weeks, 2-3 days/week, 3 hours ± 14min/day                                                             | Alpine skiing, $n=27$ , 13 women and 14 men, 67.5±2.9 years old | $n=20$ , 10 women and 10 men, 67.3 ± 4.4 years old | On average 28.5 ± 2.6 days of skiing                                | [2] $\text{VO}_{2\text{max}}$ ( $\text{mL kg}^{-1} \text{min}^{-1}$ ), $W_{\text{max}}$ $\text{kg}^{-1}$<br><br>[5] CMJ (cm), maximum isometric strength (flexion, extension), isokinetic strength (both legs, right leg, left leg) ( $\text{Nm kg}^{-1}$ and $\text{N kg}^{-1}$ ) and endurance (mean) ( $\text{N kg}^{-1}$ ),<br><br>[7] Balance: posture-o-med test, four measures (minimum path length, V)           | Two-way repeated measures ANOVA used for the between-group differences with Bonferroni's adjustment for multiple comparisons.                                       | 2 fractures while falling during the skiing    | [2] Alpine skiing: $\text{VO}_{2\text{max}}$ , CMJ, isokinetic strength with both legs increased                                                                                                                                                   |
| Naderi et al. [78] (2021), Iran           | RCT | 40 community-dwelling men (≥ 65 years old) | Table tennis (recreational), 6 months, 3 to 5 sessions/week, 1.5-hours/session                                          | Table tennis, $n=16$ , 66.3 ± 3.6 years old                     | $n=20$ , 67.0 ± 3.9 years old                      | Attendance averaged 78% ± 4 % (range: 75-120 of potential sessions) | [1] SBP (mmHg), DBP (mmHg)<br><br>[2] $\text{VO}_{2\text{max}}$ ( $\text{mL kg}^{-1} \text{min}^{-1}$ ) in cycle ergometer test<br><br>[3] BW (kg), BMI, FFM (six sites) (kg), FM (six sites) (kg), BMD ( $\text{g cm}^{-3}$ )<br><br>[7] Short Physical Performance Battery: gait speed (4 m); chair stand (timed 5-chair stand test), balance (feet together, semi-tandem, and tandem stands), 400 m walk test (all s) | A 2 x 2 (group x time) mixed-model analysis of variance used for within- and between-group comparisons. .                                                           | 1 illness, 1 ankle sprain, 2 hamstring strains | [2] Table tennis: SBP, DBP, BW, total FM, BMI decreased; total FFM, total BMD, Short Physical Performance Battery increased                                                                                                                        |
| Narici et al. [79] (2011), Austria        | CCT | 42 men and women (≥ 60 years old)          | Alpine skiing, 12 weeks, 2-3 days a week, 3.5 hours/day                                                                 | Alpine skiing, $n=22$ , 67±2 years old                          | $n=20$ , 67 ± 4 years of age                       | On average 28.5 ± 2.6 days of skiing                                | [5] maximum isokinetic torque (N), fascicle length (mm), pennation angle (degree), muscle thickness (mm)                                                                                                                                                                                                                                                                                                                 | Two-way repeated measures ANOVA with time x group interaction used for within- and between-group differences with Bonferroni's adjustment for multiple comparisons. | No reported                                    | [1] Alpine skiing: maximum isokinetic torque, fascicle length, pennation angle, muscle thickness increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in alpine skiing vs. control reported. |
| Niederseer et al. [80] (2011), Austria    | CCT | 42 men and women (≥ 60 years old)          | Alpine skiing, 12 weeks, 2-3 days a week, 3.5 hours/day                                                                 | Alpine skiing, $n=22$ , 12 women and 10 men, 66.6±2.1 years old | $n=20$ , 10 women and 10 men, 67.3 ± 4.4 years old | On average 28.5 ± 2.6 days of skiing                                | [1] SBP (mmHg), DBP (mmHg); $\text{HR}_{\text{rest}}$ (bpm)<br><br>[2] $\text{VO}_{2\text{max}}$ ( $\text{mL kg}^{-1} \text{min}^{-1}$ ), $\text{HR}_{\text{max}}$ , BP at exertion (mmHg), BP at 5 min recovery (mmHg)<br><br>[3] BMI, % fat<br><br>[4] lipid profile ( $\text{mg dL}^{-1}$ ): LDL-cholesterol, HDL-cholesterol, triglyceride, LDL-cholesterol/HDL-cholesterol ratio,                                   | Unpaired t-test used for between-group comparisons.                                                                                                                 | No reported                                    | [2] Alpine skiing: % fat decreased; $\text{VO}_{2\text{max}}$ increased                                                                                                                                                                            |

|                                                         |     |                                                                                                        |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   |                                                        |                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                   |             |                                                                                                                                                                                                                              |
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|                                                         |     |                                                                                                        |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   |                                                        |                                                                                                                    | total chol/HDL-cholesterol ratio; $\gamma$ -glutamyltransferase                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                   |             |                                                                                                                                                                                                                              |
| 55 Niederseer et al. [81] (2016), Austria               | CCT | 42 men and women ( $\geq 60$ years old)                                                                | Alpine skiing, 12 weeks, 2-3 days a week, 3.5 hours/day, $72.7 \pm 8.5$ % $HR_{max}$                                                                                                                                                                                                                                   | Alpine skiing, $n=22$ , 12 women and 10 men, $66.6 \pm 2.1$ years old                                                                             | $n=20$ , 10 women and 10 men, $67.3 \pm 4.4$ years old | On average $28.5 \pm 2.6$ days of skiing                                                                           | [1] Markers of atherogenesis: homocysteine ( $\mu\text{mol L}^{-1}$ ), early and late endothelial progenitor cells (EPCs) (% peripheral blood mononuclear cell); peripheral arterial tone: reactive hyperemia index (RHI); endothelial markers: E-selectin (ng/ml), Endothelin-1 (pg/ml), ICAM-1 (ng/ml), VCAM-1 (ng/ml), hs-CRP (mg/l)                                                      | Within-group and between-group comparisons of normally distributed parameters made by paired and unpaired t-test, and Wilcoxon-signed rank test and Mann-Whitney-U test for non-normally distributed parameters.                                  | No reported | [2] Alpine skiing: early EPCs, RHI increased; homocysteine decreased                                                                                                                                                         |
| Nordsborg et al. [82] (2015), England and Faroe Islands | RCT | 83 premenopausal women ( $45 \pm 6$ years old with mild hypertension (MAP 96-110 mmHg) and BMI $>25$ ) | 15 weeks, 3 sessions/week. Swimming: high-intensity intermittent swimming (HIS), 15-20 min (3-5 min effective swimming)/session, all out front crawl.<br><br>Moderate-intensity continuous swimming (MOS), 1 hour/session, swim as far as possible during session.<br><br>Football (small-sided) (SOC): 1 hour/session | Swimming (HIS), $n=21$ , $44 \pm 5$ years old<br><br>Swimming (MOS), $n=21$ , $46 \pm 4$ years old<br><br>Football: $n=21$ , $45 \pm 5$ years old | $n=20$ , $45 \pm 4$ years old                          | HIS $2.9 \pm 0.5$ sessions/week<br><br>MOS $2.9 \pm 0.5$ sessions/week<br><br>Football $3.0 \pm 0.4$ sessions/week | [3] FFM leg (%), FFM arm (%)<br><br>[5] Oxidative adaptive potential in upper-body (musculus deltoideus) and leg (musculus vastus lateralis) musculature: citrate synthase maximal activity, 3-hydroxyacyl-CoA dehydrogenase maximal activity (both $\mu\text{mol g}^{-1} \text{min}^{-1}$ ), Complex I-V, phosphofructokinase protein expression, muscle glycogen ( $\text{mmol kg}^{-1}$ ) | One-sample t-test used for within group changes. Differences in between-group changes were evaluated by mixed model approach with muscle and group as fixed effect. Significant main or interaction effects were evaluated with Sidak adjustment. | No reported | [2] Swimming: citrate synthase protein expression of vastus lateralis muscle, arm lean mass in HIS and MOS, leg lean mass in HIS increased<br><br>[2] Football: citrate synthase protein expression, leg lean mass increased |

|                                      |     |                                                    |                                                                                                                                                                                                 |                                                                       |                                   |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| Nybo et al. [83] (2010), Denmark     | CCT | 36 inactive men (31 years old, range 20-43 years)  | Running, 12 weeks, 1 hour/session, 2.5 times/week, 80% HR <sub>max</sub>                                                                                                                        | Running, $n=9$ , 31 $\pm$ 2 SEM years old                             | $n=11$ , 30 $\pm$ 2 SEM years old | 2.5 sessions/week                                                                                          | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg)</p> <p>[2] VO<sub>2max</sub> (ml kg<sup>-1</sup> min<sup>-1</sup>), HR at 6.5 km/h (bpm), HR at 9.5 km/h (bpm)</p> <p>[3] BW (kg), % fat, FFM (kg), FFM legs (kg)</p> <p>[4] fat oxidation during walking (kJ/min), fat oxidation during running (kJ/min), total Chol (mM), HDL-chol (mM), LDL-chol (mM) fasting glucose (mM), OGTT end glucose (mM), fasting insulin (<math>\mu</math>U/mL),</p> <p>[5] musculus vastus lateralis: capillaries per fiber, CS (<math>\mu</math>mol/g/min), HAD (<math>\mu</math>mol/g/min),</p> <p>[6] bone mass total (kg), bone mass legs (kg)</p> | Two-factor mixed ANOVA and one-way repeated measure ANOVA used for within- and between-group analyses with Newman-Keuls test when significant interaction was found.        | 2 overuse injuries                                        | <p>[1] Running: HR<sub>rest</sub>, SBP, DBP, MAP, HR at 6.5 km/h walking, HR at 9.5 km/h running, fasting glucose, OGTT end glucose, BW, % fat decreased; VO<sub>2max</sub>, capillaries per fiber (vastus lateralis), fat oxidation during running increased</p> <p>[2] No statistically significant differences between the changes in the outcome variables in running vs. control reported.</p>                               |
| Patterson et al. [84] (2017), UK     | CCT | 36 pre-menopausal women (34.3 $\pm$ 6.9 years old) | <p>Badminton, 8 weeks, 1 hour/session, 3 sessions/week, 75<math>\pm</math>5 HR<sub>max</sub></p> <p>Running, 8 weeks, 1 hour/session, 3 sessions/week, 73<math>\pm</math>3 HR<sub>max</sub></p> | <p>Badminton, <math>n=14</math></p> <p>Running, <math>n=14</math></p> | $n=8$                             | <p>Badminton 2.6 <math>\pm</math>0.2 sessions/week</p> <p>Running 2.7<math>\pm</math>0.3 sessions/week</p> | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg)</p> <p>[2] VO<sub>2max</sub> (L min<sup>-1</sup>), time-to-exhaustion (s), HR (bpm), blood lactate (mmol L<sup>-1</sup>) at 6 km/h walk and 8 km/h run, jump height</p> <p>[3] BW (kg) BMI, % fat, FFM (kg), WHR: arm, waist, hip, thigh, calf circumference (cm)</p> <p>[4] total chol, HDL-chol, LDL-chol, triglyc (all mmol/L), LDL-chol/HDL-chol ratio</p>                                                                                                                                                                                                                       | Repeated measures ANOVA used for between-group differences. Significant interactions were analyzed with post-hoc tests with Bonferroni adjustment for multiple comparisons. | 1 in badminton, 2 in running; illnesses or minor injuries | <p>[2] Badminton: HR<sub>rest</sub>, SBP, DPB, MAP, HR at 6 and 8 km/hour treadmill exercise, blood lactate at 8 km/hour treadmill exercise decreased; VO<sub>2max</sub>, time-to-exhaustion, jump height increased,</p> <p>[2] Running: HR<sub>rest</sub>, SBP, DPB, MAP, HR at 6 and 8 km/hour treadmill exercise, blood lactate at 8 km/hour treadmill exercise decreased; VO<sub>2max</sub>, time-to-exhaustion increased</p> |
| Pedersen et al. [85] (2018), Denmark | CCT | 31 elderly men (72.9 $\pm$ 3.5 years old)          | Floorball (small-sided), 12 weeks, 3 sessions/week, 60 min/session, 77 $\pm$ 7% of HR <sub>max</sub> with 10 $\pm$ 8 min exceeding 90% of HR <sub>max</sub>                                     | Floorball, $n=15$                                                     | $n=16$                            | 55% $\pm$ 15% of participants attended all sessions                                                        | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg)</p> <p>[2] VO<sub>2max</sub> (mL min<sup>-1</sup> and mL min<sup>-1</sup> kg<sup>-1</sup>), HR<sub>submax</sub> (bpm)</p> <p>[3] BW (kg), BMI, FM (kg), visceral FM (kg), FFM (kg)</p> <p>[4] HDL-chol, LDL-chol, triglyc, glucose, HbA1c (all mmol L<sup>-1</sup>) insulin (pmol L<sup>-1</sup>)</p>                                                                                                                                                                                                                                                                                            | Analysis of covariance (ANCOVA) including the groups as a categorical independent variable used for between-group effects.                                                  | No reported                                               | [2] Floorball: Leg BMD, triglyc, absolute and relative VO <sub>2max</sub> increased; HbA1c decreased                                                                                                                                                                                                                                                                                                                              |

|                                      |     |                                                                                                         |                                                                                                        |                                            |                                   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                   |                        |                                                                                                                                                                                          |
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|                                      |     |                                                                                                         |                                                                                                        |                                            |                                   |                                                                           | <p>[5] maximal isometric voluntary knee extension contraction (N), ), maximal repetitions of biceps-curl with an 8 kg dumbbell (rep), maximal hand-grip strength (kg),</p> <p>[6] leg BMD, arm BMD, total BMD (all g cm<sup>-2</sup>),</p> <p>[7] maximal sit-to-stand repetitions in 30 s (rep), time to sit-to-stand 5 repetitions (s), time to sit-to-stand (s) interspersed by a 2 x 2.45 m walk out and back around a cone (maximal distance in 6 min walking test (m).</p> |                                                                                                                                                                                                                                                   |                        |                                                                                                                                                                                          |
| Pereira et al. [87] (2020), Portugal | CCT | 67 postmenopausal women (68±6 years old)                                                                | Handball (recreational), 16 weeks, 2 sessions/week, 60 min/session, 76±6% HR <sub>max</sub>            | Handball, <i>n</i> =41                     | <i>n</i> =26                      | 1.9±04 sessions/week                                                      | <p>[1] HR<sub>rest</sub> (bpm)</p> <p>[2] VO<sub>2max</sub> (ml kg<sup>-1</sup> min<sup>-1</sup>), time to exhaustion (s)</p> <p>[4] fasting glucose, 2h OGTT glucose, total chol, HDL-chol, LDL-chol, triglyc (all mmol L<sup>-1</sup>), fasting insulin, 2-hOGTT insulin (μmol L<sup>-1</sup>), HDL-chol/LDL-chol ratio, LDL-chol/HDL-chol ratio</p> <p>[7] Yo-Yo IE1 test performance (m)</p>                                                                                 | Two-way repeated measures analysis of variance (ANOVA) used for within- and between-group changes with Bonferroni post hoc procedure. Student's unpaired t-test was used to assess delta value differences between the groups.                    | No reported            | [2] Handball: Yo-Yo IE1 test performance increased                                                                                                                                       |
| Pereira et al. [86] (2021), Portugal | RCT | 67 women, mean age 68.3 years                                                                           | Handball, 16 weeks, 2-3 sessions/week, 60 min/session, 76 ± 6 %HR <sub>max</sub>                       | Handball, <i>n</i> = 41, 67.3 ± 6.5 years  | <i>n</i> =26, 69.9 ± 5.4 years    | Mean training attendance 1.9 ± 0.4 sessions/week                          | <p>[3] BW (kg), % fat, FFM (kg)</p> <p>[6] lumbar spine BMD (g/cm<sup>2</sup>), lumbar spine BMC (g), femoral neck BMD (g/cm<sup>2</sup>), femoral neck BMC (g), femur BMD (g/cm<sup>2</sup>), femur BMC (g), CTX (ng/L), PINP (μg/L), osteocalcin (μg/L), PINP/CTX, osteocalcin/CTX</p> <p>[7] single-leg Flamingo test (number of falls)</p>                                                                                                                                   | Group and intervention effects were analyzed with two-way ANCOVA with Bonferroni post-test, with sedentary behaviour as the covariate. Student's unpaired t-test was used to analyze the differences in pre-post delta values between the groups. | One finger subluxation | [2] Handball: lumbar spine BMD, PINP, osteocalcin increased; number of falls decreased                                                                                                   |
| Póvoas et al. [88] (2018), Portugal  | CCT | 24 former male handball players (33-55 years old, no regular physical activity for the last 14±6 years) | Handball, 12 weeks, 2-3 sessions/week, 75 min/session, for outfield players mean hear rate 145±15 bpm. | Handball, <i>n</i> =15, 42.3±7.1 years old | <i>n</i> =9, 40.2 ± 5.3 years old | 2.2 ± 0.7 sessions per week or 26 ± 9 (8-26) sessions during the 12 weeks | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg), arterial stiffness (m seg<sup>-1</sup>)</p> <p>[2] VO<sub>2max</sub> (mL min<sup>-1</sup> kg<sup>-1</sup>)</p>                                                                                                                                                                                                                                                                                               | Two-way analysis of variance (ANOVA) for repeated measures with Bonferroni post hoc multiple comparison tests were used for between-group differences. Students unpaired t-test                                                                   | No reported            | [2] Handball: Yo-Yo IE2 test performance, VO <sub>2max</sub> , HDL-chol increased; HR <sub>rest</sub> , DBP, MAP, number of falls in Flamingo test, blood glucose (borderline) decreased |

|                                         |     |                                                          |                                                                                                                                                                          |                                                   |                                           |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                     |             |                                                                                                                                                                           |
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|                                         |     |                                                          |                                                                                                                                                                          |                                                   |                                           |                                                                                        | <p>[4] total chol, HDL-chol, LDL-chol (all mmol L<sup>-1</sup>), total chol/HDL-chol ratio, total chol/LDL-chol ratio, triglyc, fasting blood glucose, 2-hour OGTT blood glucose (all mmol L<sup>-1</sup>), fasting plasma insulin (μmol L<sup>-1</sup>), two-hour OGTT plasma insulin (μmol L<sup>-1</sup>)</p> <p>[5] handgrip (kg)</p> <p>[7] Yo-Yo IE2 test performance(m), single leg Flamingo test (number of falls).</p>                                                                                                                                                                                                                                                 | was used to assess the between-group differences in delta values.                                                                                                                                                   |             |                                                                                                                                                                           |
| Quist et al. [89] (2018), Denmark       | RCT | 130 women (68) and men (62) (20-45 years old, BMI 25-35) | Cycling (commuter), 6 months, 5 days/week, 320 kcal/day for women and 420 kcal/day for men                                                                               | Cycling, n=35, 12 women and 9 men, 35±7 years old | n=18, 7 women and 9 men, 35 ± 7 years old | 3.9 ± 0.4 sessions/week                                                                | <p>[2] VO<sub>2max</sub> (ml kg<sup>-1</sup> min<sup>-1</sup>), HR<sub>max</sub> (bpm), peak power output (W)</p> <p>[3] BW (kg), BMI, FM (kg), % fat, FFM (kg)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Between-group pre-post differences were evaluated with a mixed model analysis of covariance adjusted for gender and baseline variation.                                                                             | No reported | [2] Cycling: BW, FM decreased; VO <sub>2peak</sub> increased                                                                                                              |
| Rajarajan & Anandhan [90] (2018), India | CCT | 48 men (34±4 years old, BMI 25.0-29.9)                   | <p>Cycling, 12 weeks, 6 sessions/week, 45-60 min/session</p> <p>Swimming, 12 weeks, 6 sessions/week, 45-60 min/session</p>                                               | <p>Cycling n=12</p> <p>Swimming n=12</p>          | n=12                                      | No information                                                                         | [2] VO <sub>2max</sub> (ml kg <sup>-1</sup> min <sup>-1</sup> ), vital capacity (l/min),                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ANCOVA was used to compare the between-group post means after adjusting for the pre-test values, and Scheffe's post hoc test for paired mean differences.                                                           | No reported | <p>[2] Cycling: vital capacity, VO<sub>2max</sub> increased</p> <p>[2] Swimming: vital capacity, VO<sub>2max</sub> increased</p>                                          |
| Randers et al. [92] (2010), Denmark     | CCT | 22 untrained men (20-43 years old)                       | Football (small-sided), 64 weeks, 1 hour/session, 2.4 sessions/week for the first 12 weeks, 1.3 sessions/week for the following 52 weeks, 82 ± 2 % SEM HR <sub>max</sub> | Football, n=10, 20-43 years old                   | n=7, 20-43 years old                      | 2.4 sessions/week for the first 12 weeks, 1.3 sessions/week for the following 52 weeks | <p>[1] HR<sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg)</p> <p>[2] VO<sub>2max</sub> (ml kg<sup>-1</sup> min<sup>-1</sup>), VE<sub>max</sub> (L min<sup>-1</sup>), HR (bpm) at 6.5/ 8.0/ 9.5/11.0 km/h), treadmill test time (min)</p> <p>[3] BW (kg), FM (kg), upper body FM (kg), legs FM (kg), % fat,</p> <p>[4] total chol (mM), HDL-chol (mM), LDL-chol (mM), triglyc (mM), fasting blood glucose (mM), blood glucose 2-hour OGTT (mM), glycogen content ((mmol/kg d.w</p> <p>[5] quadriceps muscle mass right and left leg (kg), muscle CS activity (μmol/g d.w./min), muscle HAD activity (μmol/g d.w./min), mean fiber size (μm<sup>2</sup>), jump height (cm), jump</p> | Repeated measure one-way ANOVA for within-group differences. One-way ANOVA for between-group differences in pre/post delta values with Student-Newman-Keuls post hoc test when significant main effects were found. | No reported | [2] Football: FM, % fat, HR <sub>rest</sub> , SBP decreased; quadriceps muscle mass right and left leg, jump height, plantar force, plantar work, plantar power increased |

|                                     |     |                                         |                                                                                                                                                  |                                                                    |                                           |                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                   |                                                                                      |                                                                                                                                                                                                                                                                                            |
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|                                     |     |                                         |                                                                                                                                                  |                                                                    |                                           |                                                                       | height above ground (cm), plantar force (N/kg), plantar work (J/kg), plantar power (Watt/kg), concentric work (J/kg)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                   |                                                                                      |                                                                                                                                                                                                                                                                                            |
|                                     |     |                                         |                                                                                                                                                  |                                                                    |                                           |                                                                       | [6] total BMD (mg/cm <sup>3</sup> ), BMD legs (mg/cm <sup>3</sup> ), total BMC (kg), BMC legs (kg)                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                   |                                                                                      |                                                                                                                                                                                                                                                                                            |
|                                     |     |                                         |                                                                                                                                                  |                                                                    |                                           |                                                                       | [7] balance right leg (falls/1 min), balance left leg (falls/1 min), Yo-Yo IE2 test performance (m), 30-m sprint time (s)                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                   |                                                                                      |                                                                                                                                                                                                                                                                                            |
| Randers et al. [91] (2018), Denmark | CCT | 52 untrained men (28.4±7.0 years old)   | Basketball, 3 months, 2-3 sessions/week, 75 min/sessions, 83.8%±6.0% HR <sub>max</sub>                                                           | Basketball (full court), n=13<br><br>Basketball (half court), n=12 | n=10                                      | No information                                                        | [1] HR <sub>rest</sub> (bpm), SBP (mmHg), DBP (mmHg), MAP (mmHg)<br><br>[2] VO <sub>2max</sub> (ml min <sup>-1</sup> kg <sup>-1</sup> ), time to exhaustion (treadmill running) (s), blood lactate concentration after submaximal running at 8 km h <sup>-1</sup> (mmol L <sup>-1</sup> )<br><br>[3] % fat, BF, android % fat, BW (kg), FFM (kg),<br><br>[4] fasting blood glucose, total chol, HDL-chol, LDL-chol, triglyc (all mmol L <sup>-1</sup> ), plasma insulin (μmol L <sup>-1</sup> ),<br><br>[6] leg BMC (g), whole-body BMC (g), whole-body BMD (g/cm <sup>2</sup> ) | One-way analysis of variance (ANOVA) was used to compare the between-group changes.                                                                                                                               | 2 minor injuries in full court basketball, 2 minor injuries in half-court basketball | [2] Basketball (full court): SBP, MAP, blood lactate <sub>submax</sub> , BF, android % fat decreased; VO <sub>2max</sub> , time-to-exhaustion, whole-body BMD increased<br><br>[2] Basketball (half court): VO <sub>2max</sub> , time-to-exhaustion increased; BF, android fat % decreased |
| Sareban et al. [93] (2020), Austria | CCT | 73 women (44%) and men (46±9 years old) | Cycling (commuter), 12 months, 150 min/week                                                                                                      | Cycling, n=22, 12 women and 10 men, 44 to 51 years old             | n=17, 12 women and 5 men, 39-50 years old | 1159-2187 km/year                                                     | [1] SBP (mmHg), DBP (mmHg)<br><br>[3] BW (kg), BMI, waist- and hip circumference (mm), WHR, skinfold (mm)<br><br>[4] fasting blood glucose (mg dL <sup>-1</sup> ), HbA1c (dl), total chol, HDL-chol, LDL-chol, triglyc (mmol L <sup>-1</sup> ) (mg dL <sup>-1</sup> ), LDL-chol/HDL-chol ratio                                                                                                                                                                                                                                                                                   | Comparison of between-group changes was done by one-way ANCOVA using baseline values and gender as covariates, and subsequent post hoc testing with Bonferroni correction.                                        | No reported                                                                          | [1] Cycling: no statistically significant within-group changes were found<br><br>[2] No statistically significant differences between the changes in the outcome variables in cycling vs. control reported.                                                                                |
| Schmidt et al. [94] (2014), Denmark | CCT | 32 untrained men (65-75 years old)      | Football (small-sided), 1 hour/session, two sessions/week during the first 4 months and 1 hour/session three sessions/week for the last 8 months | Football, n=9, 68.0±4.0 years old                                  | n=8, 67.4 ± 2.7 years old                 | 66% ±12% of all training sessions, on average 1.7 ± 0.3 sessions/week | [1] HR <sub>rest</sub> (bpm), SBP (mmHg), DPB (mmHg); echocardiography: (a) left ventricular (LV) structure: interventricular thickness, posterior wall thickness, end-diastolic diameter (all in cm), end-diastolic volume (mL), mass index (g/bsa); (b) systolic                                                                                                                                                                                                                                                                                                               | Two-way ANOVA with repeated measurements was used for analyzing the within- and between-group changes. When a significant time by group interaction was found the Student-Newman-Keuls post hoc test was applied. | 1 achilles tendon injury                                                             | [2] Football: VO <sub>2max</sub> , TAPSE, pulsed TDI E', EF biplane, global strain, E/A ratio, and E' increased; HR <sub>rest</sub> decreased                                                                                                                                              |

|                                           |     |                                                                                |                                                                                                                                                                                                                                     |                                                        |                           |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                         |                          |                                                                                                                                                                                                        |
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|                                           |     |                                                                                |                                                                                                                                                                                                                                     |                                                        |                           |                                      | function: EF biplane (%), tricuspid annular plane systolic excursion (TAPSE), pulsed TDI S' (cm s <sup>-1</sup> ), global strain (%), negative values), LV displacement (mm); (c) diastolic functions: mitral inflow velocity E/A ratio, mitral valve deceleration time (MS), E/E', pulsed TDI E' (cm s <sup>-1</sup> ), pulsed TDI A' (cm s <sup>-1</sup> ), pulmonary augmentation index (AI)<br><br>2) Endurance fitness: VO <sub>2max</sub> (mL min <sup>-1</sup> kg <sup>-1</sup> ) |                                                                                                                                                                                                         |                          |                                                                                                                                                                                                        |
| Seynnes et al. [95] (2011), Austria       | CCT | 42 men and women (67±2 years old)                                              | Alpine skiing, 12 weeks, 2-3 days a week, 3.5 hours/day                                                                                                                                                                             | Alpine skiing, n=21 (11men, 10 women) (67±2 years old) | n=18, 6 7 ± 4 years old   | on average 28.5 ± 2.6 days of skiing | [5] isometric torque (Nm), patellar tendon length, tendon mean cross sectional area (CSA) (mm <sup>2</sup> ), tendon CSA (a.u) – proximal, middle, distal, and mean, tendon stiffness (N mm <sup>-1</sup> ), Young's modulus (Gpa), strain (%)                                                                                                                                                                                                                                           | Two-way ANOVA with time x training interaction was used for the analyses of between-group changes with Bonferroni post hoc test for multiple comparisons.                                               | No reported              | [1] Alpine skiing: tendon stiffness, Young's modulus increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in alpine skiing vs. control reported. |
| Shimada et al. [96] (2018), Japan         | RCT | 106 adults (57 men, 49 women) (≥65 years old, who did play golf <2 times/week) | Golf, 24 weeks, 1 sessions/week, 90-120 min/session. Participants also performed home-based golf practice each day.                                                                                                                 | Golf, n=53                                             | n=47                      | 96,2 % (51/53 participants)          | [5] grip strength (kg)<br><br>[7] walking speed (s),                                                                                                                                                                                                                                                                                                                                                                                                                                     | Linear mixed model with random intercept was used for the analyses of the between-group changes. The fixed components of the model included effects of group and time and a group x time interaction.   | No reported              | [1] Golf: No statistically significant within-group changes were found<br><br>[2] No statistically significant differences between the changes in the outcome variables in golf vs. control reported.  |
| Skoradal et al. [97] (2018), Faroe Island | CCT | 50 women (25) and men (25) (55 - 70 years old with prediabetes)                | Football (small-sided), 16 weeks, 2 sessions/week, 30- 60 min/session, 79±1% mean HR <sub>max</sub> , 96±1% peak HR <sub>max</sub>                                                                                                  | Football, n=27, 14 women and 13 men                    | n=23, 11 women and 12 men | 2.0 ± 0.1 sessions/week              | [6] BMC (g) and BMD (g cm <sup>-2</sup> ): whole body, head, chest, midriff, pelvis, leg and arm; bone turnover marks: plasma osteocalcin, PINP and CTX-1 (ng mL <sup>-1</sup> )                                                                                                                                                                                                                                                                                                         | Two-factor mixed ANOVA with Bonferroni post-hoc test was used to test the intervention-induced between-group differences.                                                                               | No reported              | [2] Football: leg BMD, leg BMC, CTX-1, PINP, osteocalcin increased                                                                                                                                     |
| Sundstrup et al. [98] (2016), Denmark     | CCT | 27 untrained men (68.2±3.2 years old)                                          | Football (small-sided), 12 months, 1 hour/session/ twice/week during the first 4 months and 1 hour/session 3 times/week during the last 8 months. Mean HR 138±3 and 143±3 bpm. during training in week 1 and week 16, respectively. | Football, n=9                                          | n=8                       | No information                       | [5] concentric quadriceps (Q), eccentric Q, isometric Q, isometric hamstring (H) (all Nm), Quadriceps rapid force capacity (RFD), rate of force development) and Hamstring RFD (all N s <sup>-1</sup> ), CMJ (cm)<br><br>[7] sit-to-stand (n), stair ascent (s)                                                                                                                                                                                                                          | Outcome variables were analyzed using a repeated measure 3 x 3 mixed factorial design with time. group and time by group as independent categorical variables. Baseline values were used as covariates. | 1 achilles tendon injury | [2] Football: Hamstring, RFD, sit-to-stand test increased; time for stair ascent decreased                                                                                                             |

|                                            |     |                                                                                                                          |                                                                                                                                                                                           |                                                         |                                   |                                                            |                                                                                                                                                                                                                                                                      |                                                                                                                            |                 |                                                                                                                                                                                                                                                                                                                                                         |
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| Tiberiu & Iacob [99] (2019), Romania       | CCT | 43 women (17) and men (26), (23-38 years old)                                                                            | Tennis (recreational). 4,5 months, 2 session/week, 90 min/session                                                                                                                         | Tennis, $n=27$ , 12 women and 15 men                    | $n=16$ , 5 women and 11 men       | No information                                             | [2] $VO_{2max}$ (ml $kg^{-1}$ $min^{-1}$ )<br><br>[5] vertical jump (cm), bent-arm-hang (sec), hand grip (kg),<br><br>[7] sit-and-reach (cm) single leg balance (repetitions), plate tapping (sec), 20m shuttle run (level)                                          | Paired samples t-test, Wilcoxon test, and Mann-Whitney test used for within-group differences.                             | No reported     | [2] Tennis: Hand grip, bent-arm-hang, shuttle run test performance, $VO_{2max}$ increased                                                                                                                                                                                                                                                               |
| Tomar & Allen [100] (2021), Saudi Arabia   | CCT | 24 male college students (intervention group $19.78 \pm 1.05$ years old, control group $19.60 \pm 0.96$ years old)       | Handball, 12 weeks, 30 min/session, 2 times/week                                                                                                                                          | Handball, $n=14$                                        | $n=10$                            | Attendance 94.6 %                                          | [1] SBP (mmHg), DBP (mmHg), HR (bpm)<br><br>[2] $VO_{2max}$ (ml/kg/min, estimated from single-stage treadmill walking test)<br><br>[3] % fat                                                                                                                         | Between-group differences in delta values tested by independent T-test                                                     | No reported     | [2] Handball: % fat decreased                                                                                                                                                                                                                                                                                                                           |
| Tomar & Antony [101] (2019a), Saudi Arabia | CCT | 35 untrained men (19.08 years old))                                                                                      | Football (6 players/group), 16 weeks, 30 min/session, HR during play $165.18 \pm 9.69$ bpm<br><br>Football (4 players/group), 16 weeks, 30 min/session, HR during play $169 \pm 8.95$ bpm | Football 6/group, $n=16$<br><br>Football 4/group, $n=8$ | $n=15$                            | No information                                             | [1] SBP (mmHg), DBP (mmHg), HR (bpm)<br><br>[3] BW (kg), % fat<br><br>[4] HbA1C, Fasting sugar (mg/dl), Tot Chol (mg/dl), triglyc (mg/dl), HDL-Chol (?), LDL-Chol (%), VLDL-Chol (%)                                                                                 | Between-group differences in delta values tested by one-way ANOVA with Bonferroni post-hoc test                            | No reported     | [1] Football 6/group: SBP decreased, DBP decreased, HR decreased; football 4/group: HR decreased<br><br>[3] Football 6/group: BW and % fat decreased; football 4/group BW and % fat decreased<br><br>[4] Football 6/group: fasting sugar, triglyc, VLDL decreased; football 4/group: HbA1C, Tot Chol, LDL-Chol, VLDL-Chol decreased, HDL-Chol increased |
| Tomar & Antony [102] (2019b), Saudi Arabia | CCT | 24 male undergraduate students (intervention group $19.63 \pm 0.67$ years old, control group $19.90 \pm 0.70$ years old) | Basketball (recreational, 3 players/side), 12 weeks, 30 min/session, HR during play $167.82 \pm 9.00$ bpm)                                                                                | Basketball, $n=12$                                      | $n=12$                            | Attendance 91.66 %                                         | [1] SBP (mmHg), DBP (mmHg), HR (bpm)<br><br>[2] $VO_{2max}$ (ml/kg/min, estimated from single-stage treadmill walking test)<br><br>[3] BW (kg), BMI, % fat, LBM (kg)                                                                                                 | Between-group differences in delta values were tested by independent T-test                                                | No reported     | Basketball:<br>[1] HR increased<br><br>[2] $VO_{2max}$ increased<br><br>[3] % fat increased                                                                                                                                                                                                                                                             |
| Trajković et al. [103] (2020), Serbia      | CCT | 26 men (35-55 years old)                                                                                                 | Volleyball (small-sided), 10 weeks, 90 min/session, 2-3 sessions/week                                                                                                                     | Volleyball, $n=12$ , $44.7 \pm 6.3$ years old           | $n=12$ , $42.9 \pm 8.7$ years old | $25 \pm 7$ sessions of the 30 sessions during the 10 weeks | [1] $HR_{rest}$ (bpm), SBP (mmHg), DBP (mmHg)<br><br>[3] BW (kg), BMI<br><br>[4] total chol, HDL-chol, LDL-chol, triglyc, blood glucose (all mmol $L^{-1}$ )<br><br>[5] handgrip strength (kg),<br><br>[7] Yo-Yo intermittent recovery test-level 2 (Yo-Yo IRT2) (m) | Repeated measure ANOVA with Bonferroni post hoc multiple comparison tests were used for within- and between-group changes. | 2 ankle sprains | [2] Volleyball: $HR_{rest}$ , Yo-Yo IRT2 increased; LDL-cholesterol decreased                                                                                                                                                                                                                                                                           |
| van Ginkel et al. [104] (2015), Austria    | CCT | 47 men (24) and women (23) ( $\geq 60$ years old)                                                                        | Alpine skiing, 12 weeks, 2-3 days/week, 3.5 hours/day                                                                                                                                     | Alpine skiing, $n=19$ , $67 \pm 2$ years old            | $n=20$ , $67 \pm 4$ years old     | On average $28.5 \pm 2.6$ days of skiing                   | [2] $VO_{2max}$ (ml/kg/min), $P_{max}$ (watts), $P_{max}/BW$<br><br>[3] BW (kg), BMI, % fat                                                                                                                                                                          | One-way repeated analysis of variance with a two-tailed post-hoc                                                           | No reported     | [1] Alpine skiing: $VO_{2max}$ , thickness and CSA of slow fibers of vastus lateralis muscle increased; BMI, % fat decreased                                                                                                                                                                                                                            |

|                                          |     |                                                                                |                                                                                                              |                                      |                              |                |                                                                                                                                                                                                             |                                                                                              |             |                                                                                                                                                                                                     |
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|                                          |     |                                                                                |                                                                                                              |                                      |                              |                | [5] Vastus lateralis muscle: thickness (mm), CSA ( $\mu\text{m}^2$ ), capillary density, slow fiber area (%), mitochondrial proteins, markers of mitochondrial respiratory complex I, II, III, and V, GLUT4 | test of Fisher was used for between group changes.                                           |             | [2] No statistically significant differences between the changes in the outcome variables in alpine skiing vs. control reported.                                                                    |
| Witte et al. [105] (2017), Germany       | CCT | 93 older adults (58 women, 35 men) (63 -83 years old)                          | Karate, 5 months, two sessions/week, 60 min/session                                                          | Karate, $n=28$                       | $n=26$                       | No information | [7] chair stands test (sec), walking speed over 4m ( $\text{m s}^{-1}$ ), balance ability (static and dynamic) (points)                                                                                     | T-test used for the within-group changes.                                                    | No reported | [1] Karate: chair stands, walking speed, dynamic balance increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in karate vs. control reported. |
| Yoshimuraa & Imamura [106] (2010), Japan | CCT | 15 women, mean age 21.1 years (intervention group), 20.2 years (control group) | Karate, 10 weeks, 4 sessions/week, 30 min/session, 9 min 33.3 + 12 min 44.4 + 9 min 53.8 %VO <sub>2max</sub> | Karate, $n=9$ , 21.1 $\pm$ 0.9 years | $n=6$ , 20.2 $\pm$ 0.4 years | No information | [2] VO <sub>2max</sub> (l/min and ml/kg/min), HR <sub>max</sub> (bpm), peak La (mmol/L)<br><br>[3] BW (kg), % fat                                                                                           | Data between intervention and control group were analyzed by non-paired Mann-Whitney U test. | No reported | [1] Karate: VO <sub>2max</sub> increased<br><br>[2] No statistically significant differences between the changes in the outcome variables in karate vs. control reported.                           |

<sup>a</sup> RCT=randomized controlled trial, CCT=controlled clinical trial

<sup>b</sup> note that this is reported differently across studies

A=peak transmittal flows velocity in late diastole, A'=late diastolic velocity, AKT=akt cell signaling, ANOVA=analyses of variance, AUC=area under curve, BF=body fat, BH=body height, BIDA=body image dimensional assessment, BMC=bone mineral content, BMD=bone mineral density, BMI=body mass index, BP=blood pressure, bpm=beats per minute, BW=body weight, C:F ratio=capillary density, Chol=cholesterol, circumf.=circumference, CP=creatine phosphate, CMJ=counter movement jump, CRP=C-reactive protein, CS=citrate synthase, CSA=cross-sectional area, CTX-1=carboxy terminal collagen crosslinks, DBP=diastolic blood pressure, E=peak transmittal flow in early diastole, E'=early diastolic velocity, EF=ejection fraction, EMG=electromyography, EPC=endothelial progenitor cell, f=fat, FFM=fat-free mass, FM=fat mass, FT=fast twitch, GLUT4=glucose transport protein, HAD=beta-hydroxyacyl-CoA-dehydrogenase, HbA1c=glycosylated hemoglobin, HDL-chol=high density lipoprotein cholesterol, HIS=high-intensity intermittent swimming, HIT=high-intensity intermittent training, HOMA IR=homeostatic model assessment of insulin resistance, HOMA 2=insulin resistance index, HR=heart rate, HRrest=heart rate at rest, HRsubmax=submaximal hear rate, ICAM-1=intracellular adhesion molecule-1, IL=interleukin, IVRTaveraged=average isovolumetric relaxation time, IVRTglobal=global isovolumetric relaxation time, IVSd=intraventricular septum thickness in diastole, LDL chol=low density lipoprotein cholesterol, LIT=low intensity training, LTPA=leisure-time physical activity, LV=left ventricular, LVDD=left ventricular end-diastolic diameter, LVEF=left ventricular end-diastole ejection fraction, LVPWd=left ventricular posterior wall thickness in diastole, LVSD=left ventricular end-systolic diameter, MANOVA=multivariate analyses of variance, MAP=mean arterial pressure, MCSA=muscle cross-sectional area, MEF2A=mitochondrial myocyte enhancer factor 2A, MET=metabolic equivalent of task, MM=muscle mass, MOD=moderate-intensity, MOS=moderate-intensity continuous swimming, MVIC=maximal voluntary isometric contraction, MVC=maximal voluntary contraction, NRF=nuclear respiratory factor 1 and 2, OGTT=oral glucose tolerance test, PCR=phosphorylated creatine, PFK=phosphofructokinase, PGC-1 $\alpha$ =receptor gamma activator-1alpha, Pmax=maximal power, pNN50=number of pairs of adjacent intervals differing by >50 ms divided by the total number of intervals, P1NP=procollagen type 1 N aminotermal peptide, P53=tumor protein, RER=respiratory exchange ratio, RFD=rate of force development, RHI=reactive hyperemia index, RHR=resting heart rate, RVDD=right ventricular end-diastole diameter, S'=systolic velocity, S'color TDI=peak systolic velocity, SBP=systolic blood pressure, SD1=short-term variability in point-care' plot, SEM=standard error of the mean, SIRT1=silent information regulator 1, ST=slow twitch, TAPSE=tricuspid annular plane systolic excursion, TB-FFM=total body fat-free mass, TB-FM=total body fat mass, TBW=total body water, TDI=tissue Doppler imaging, Tfam=mitochondrial transcription factor, TNF=tumor necrosis factor, total chol=total cholesterol, triglyc=triglycerides, T-score=standard deviation of BMD or BMC value, TTindex=standard apical projections, V=ventilation, VCAM-1=vascular adhesion molecule-1, VE=minute ventilation, VLDL=very low density lipoprotein cholesterol, VO<sub>2max</sub>=maximal oxygen uptake, VO<sub>2peak</sub>= peak oxygen uptake, WC=waist circumference, WHR=waist-to-hip ratio, Yo-YoIE 1, 2=YoYo intermittent endurance test (levels 1 and 2), YYIRT2=Yo-Yo intermittent recovery test (level 2)