**Appendix**

**Table A1: Characteristics of included studies**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Author [Year] | Study design | Selection criteria | Sports involved | Number of patients  (% male) | Age, year,  mean ± SD | Intervention |
| Chang [2019] | RCT | Healthy male college athletes | Intense training | L: 20 (NA)  C: 20 (NA) | L: 20.90 ± 1.12 C: 21.05 ± 1.53 | L: 830 nm and 36 J LLLT in Tianquan and Chihtseh acupoint on each arm before training  C: Sham |
| da Cunha [2020] | RCT | Healthy male volleyball players aged 17–18 years | Plyometric training | L: 12 (100)  C: 12 (100)  N: 12 (100) | N: 17.7 ± 0.5  L: 17.7 ± 0.7  C: 17.7 ± 0.6 | L: 850 nm and 36 J LLLT on the quadriceps before training  C: Only received training  N: Electrically elicit quadriceps while training |
| de Marchi [2019] | Crossover | Professional male athletes aged 18–35 years | Futsal match | L1: 3 (100)  L2: 3 (100) | 26.16 ± 6.91 | L1: 905, 875, and 640 nm and 510 J LLLT on the lower limb before official match, and washout for 2 weeks; then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| de Oliveira [2017] | RCT | High-level male soccer athletes aged 18–35 years | Eccentric contraction protocol | L1: 7 (100)  L2: 7 (100)  L3: 7 (100)  C: 7 (100) | 18.62 ± 0.73 | L1: 810 nm, 100 mW, and 300 J LLLT on the quadriceps before the eccentric contraction protocol  L2: 810 nm, 200 mW, and 300 J LLLT on the quadriceps before the eccentric contraction protocol  L3: 810 nm, 400 mW, and 300 J LLLT on the quadriceps before the eccentric contraction protocol  C: Sham |
| Denis [2013] | Crossover | Healthy male athletes | Yo–Yo intermittent recovery test | L1: 9 (100)  L2: 8 (100) | 22.1 ± 4.1 | L1: 660 and 950 nm and 103.8 J LLLT on the lower limb after Yo–Yo intermittent recovery test, washout 1 week and then crossover to placebo group  L2: Sham at first and then crossover to the LLLT group |
| Dornelles [2019] | Crossover | Amateur male soccer players aged <25 years | Simulated soccer match | L1: 6 (100)  L2: 6 (100) | 25.17 ± 4.04 | L1: 880 nm and 300 J LLLT on the hamstring before match, washout for 1 week, and then crossover to placebo group  L2: Sham at first and then crossover to the LLLT group |
| Ferraresi [2015] | RCT | Professional male volleyball players | Official match | L1: 3 (100)  L2: 3 (100)  L3: 3 (100)  C: 3 (100) | 25.5 ± 5.3 | L1: 850 and 630 nm and 315 J LLLT on the low limb  L2: 850 and 630 nm and 630 J LLLT on the low limb  L3: 850 and 630 nm and 945 J LLLT on the low limb  C: Sham |
| Hemmings [2017] | Crossover | Athletes aged 18–26 years | Voluntary contraction test | 34 (53) | 21.1 ± 2.0 | L1: 660 and 850 nm and 250.2 J LLLT on the quadriceps, washout for 1 month, and then crossover to other groups  L2: 660 and 850 nm and 500.4 J LLLT on the quadriceps, washout for 1 month, and then crossover to other groups  L3: 660 and 850 nm and 1000.8 J LLLT on the quadriceps, washout for 1 month, and then crossover to other groups  C: Sham at first and then crossover to other groups |
| Lanferdini [2018] | Crossover | Healthy male cyclist aged 29 years | Exhaustion test | L1: 5 (100)  L2: 5 (100)  L3: 5 (100)  L4: 5 (100) | 29 | L1: 810 nm and 135 J LLLT on the quadriceps muscles before test, washout 1 day, and then crossover to other groups  L2: 810 nm and 270 J LLLT on quadriceps muscles before test, washout 1 day, and then crossover to other groups  L3: 810 nm and 405 J LLLT on quadriceps muscles before test, washout 1 day, and then crossover to other groups  L4: Sham at first and then crossover to other groups |
| Leal-Junior [2008] | RCT | Professional male volleyball players  aged 18–35 years | Voluntary contraction test | L: 6 (100)  C: 6 (100) | 22 ± 3 | L: 655 nm and 20 J LLLT on the biceps before test  C: Sham |
| Leal-Junior  [2009a] | Crossover | Professional male volleyball players aged 18–36 years | Exercise fatigue test | L1: 5 (100)  L2: 5 (100) | 22.30 ± 6.09 | L1: 830 nm and 20 J LLLT on the biceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Leal-Junior  [2009b] | Crossover | Male soccer or volleyball players  aged 15–36 years | Exercise fatigue test | 20 (100) | S: 20.67 ± 2.96  V: 16.18 ± 0.75 | S: 830 nm and 15 J LLLT on the quadriceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  V: 830 nm and 20 J LLLT in the quadriceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  C: Sham at first and then crossover to the LLLT group |
| Leal-Junior  [2009c] | Crossover | Professional male volleyball players  aged 18–36 years | Exercise fatigue test | L1: 5 (100)  L2: 5 (100) | 23.6 ± 5.6 | L1: 660 and 850 nm and 41.7 J LLLT on the biceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Leal-Junior  [2009d] | Crossover | Male volleyball players aged 17–20 years | Wingate test | 8 (100) | 18.50 ± 0.93 | L1: 660 and 850 nm and 83.4 J LLLT on the quadriceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  L2: 810 and 12 J LLLT on the quadriceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  C: Sham at first and then crossover to the LLLT group |
| Leal-Junior [2010] | Crossover | Male volleyball players aged 18–20 years | Exercise fatigue test | L1: 5 (100)  L2: 4 (100) | 18.6 ± 1.0 | L1: 810 nm and 60 J LLLT on the biceps before exercise fatigue test, washout for 1 week, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Liu  [2020] | Crossover | Healthy college male swim athletes aged 18–23 years | 200 m breaststroke  swimming test | L1: 8 (100)  L2: 8 (100) | 22.4 ± 1.6 | L1: 632.8 nm and 30 J LLLT on each quadriceps before swimming test, washout for 2 weeks, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Maciel  [2013] | Crossover | Female volleyball athletes aged 18–27 years | Jumping ability test | 7 (0) | 22.57 ± 3.82 | L1: 830 nm and 220 J LLLT on the triceps surae before test, washout for 2 days, and then crossover to the placebo group  L2: Sham at first and then crossover to LLLT group |
| Medeiros [2020] | RCT | Male athletes aged 18–40 years | Intense training | L: 11 (100)  C: 11 (100) | L: 30.36 ± 7.06  C: 28.00 ± 7.42 | L: 850 nm and 90 J LLLT on above and below the site of pain on hamstring  C: Sham |
| Pinto [2016] | Crossover | High-level male rugby players aged 19–26 years | Bangsbo sprint test | L1: 6 (100)  L2: 6 (100) | 23.50 ± 2.32 | L1: 905, 875, and 640 nm and 510 J LLLT on the lower limb before test, washout for 1 week, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Reis [2014] | RCT | Professional male soccer player aged 15–30 years | Stretching  sessions | LE: 9 (100)  LT: 9 (100)  C: 9 (100) | 22.62 ± 8.03 | LE: 830 nm and 25.2 J LLLT on the quadriceps before test  LT: 830 nm and 25.2 J LLLT on the quadriceps after test  C: Sham |
| Takenori [2016] | RCT | Healthy college athletes | Various | L: 16 (44)  C: 16 (44) | L: 20.25 ± 1.18  C: 20.88 ± 2.25 | L: 810 nm and 5.4 J LLLT on each site of pain including the upper limbs, lower limbs, and body trunk  C: Sham |
| Tomazoni [2019] | Crossover | High-level male soccer players | Progressive running test | L1: 11 (100)  L2: 11 (100) | 18.85 ± 0.61 | L1: 810 nm and 850 J LLLT on the lower limb before ergospirometry assessment, washout for 2 weeks, and then crossover to the placebo group  L2: Sham at first and then crossover to the LLLT group |
| Vanin [2016] | RCT | Professional male soccer athletes aged 18–35 years | Exercise protocols | L1: 7 (100)  L2: 7 (100)  L3: 7 (100)  C: 7 (100) | 18.81 ± 0.80 | L1: 810 nm and 60 J LLLT on the quadriceps before exercise  L2: 810 nm and 180 J LLLT on the quadriceps before exercise  L3: 810 nm and 300 J LLLT on the quadriceps before exercise  C: Sham |
| Zagatto [2016] | RCT | Male polo players | Training sessions | L: 10 (100) C: 10 (100) | 15.4 ± 1.2 | L: 810 nm and 24 J LLLT on the adductor magnus and longus muscle after daily training  C: Sham |

†Laser energies were recorded per limb.

Abbreviations: L: laser therapy group, C: control group, T: training group, S: soccer players, V: volleyball players, LE: preexercise laser, LT: postexercise laser, RCT: randomized controlled trial.

**Table 2: Assessment of methodological quality of included trials**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Author [Year] | Randomizing process | Deviation from the  intended treatment | Missing outcome data | Measurement of outcome | Selection of the reported result | Overall risk |
| Chang [2019] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| da Cunha [2020] | Some concern | Low risk | Low risk | Low risk | Low risk | Some concern |
| de Marchi [2019] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| de Oliveira [2017] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Denis [2013] | Some concern | Low risk | Some concern | Low risk | Low risk | Some concern |
| Dornelles [2019] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Ferraresi [2015] | Low risk | Low risk | Low risk | Low risk | Some concern | Some concern |
| Hemmings [2017] | Some concern | Low risk | Low risk | Low risk | Low risk | Some concern |
| Lanferdini [2018] | Some concern | Some concern | Low risk | Low risk | Some concern | Some concern |
| Leal-Junior [2008] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Leal-Junior  [2009a] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Leal-Junior  [2009b] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Leal-Junior  [2009c] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Leal-Junior  [2009d] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Leal-Junior [2010] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Liu  [2020] | Some concern | Low risk | Low risk | Low risk | Low risk | Some concern |
| Maciel  [2013] | Some concern | Some concern | Low risk | Low risk | Some concern | Some concern |
| Medeiros [2020] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Pinto [2016] | Low risk | Some concern | Low risk | Low risk | Low risk | Some concern |
| Reis [2014] | Low risk | Low risk | Low risk | Low risk | Some concern | Some concern |
| Takenori [2016] | Some concern | Low risk | Low risk | Some concern | Low risk | Some concern |
| Tomazoni [2019] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Vanin [2016] | Low risk | Low risk | Low risk | Low risk | Low risk | Low risk |
| Zagatto [2016] | Some concern | Low risk | Low risk | Low risk | Low risk | Some concern |

**Figure A1**. Forest plot of comparison: LLLT and control. Outcome: muscle strength.

Table

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**Figure A2**. Forest plot of comparison: LLLT and control. Outcome: contract repetition number.

**Table

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**Figure A3**. Forest plot of comparison: LLLT and control. Outcome: soreness index.

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**Figure A4.** Forest plot of comparison: LLLT and control. Outcome: time to fatigue.

Table

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**Figure A5**. Forest plot of comparison: LLLT and control. Outcome: serum creatine kinase concentration.

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**Figure A6.** Forest plot of comparison: LLLT and control. Outcome: serum creatine kinase concentration (48-hour follow-up).

Table

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**Figure A7.** Forest plot of comparison: LLLT and control. Outcome: serum lactate concentration.

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**Figure A8**. Forest plot of comparison: LLLT and control. Outcome: inflammatory-related factors.

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**Figure A9.** Forest plot of comparison: LLLT and control. Outcome: serum TBARS concentration.

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