**Table S1**. The search terms used in the review to identify dynamics forces and kinematic indicators of the front and roundhouse kick. These search terms were used in Web of Science, PubMed, and SportDicsus databases. Full text, search was conducted from 1982 to 19th May 2022, Humans, English.

|  |  |
| --- | --- |
| Web of Science | Topic (((((((((ALL=(front kick\*)) OR ALL=(roundhouse kick\*)) OR ALL=(Mae-Geri\*)) OR ALL=(Apchagi\*)) OR ALL=(Dollyo\*)) OR ALL=(Mawashi\*)) NOT ALL=(Swimming\*)) NOT ALL=(Football\*)) NOT ALL=(Rugby\*)) NOT ALL=(Futsal\*)  Limit to: Date from 1982 to 19th May 2022, Article, English |
| PubMed | (((((((((front kick\*[Title/Abstract])) OR (roundhouse kick\*[Title/Abstract]))) OR (Mae-Geri\*[Title/Abstract]))) OR (Apchagi\*[Title/Abstract]))) OR (Dollyo\*[Title/Abstract]))) OR (Mawashi\*[Title/Abstract]))) NOT (Swimming\*[Title/Abstract]))) NOT (Footbal\*[Title/Abstract]))) NOT (Rugby\*[Title/Abstract]))) NOT (Futsal\*[Title/Abstract]))  Limit to: from 1982 to 19th May 2022, Article, Humans, English |
| SportDiscus | TITLE-ABS-KEY front kick\* OR roundhouse kick\* OR Mae-Geri\* OR Apchagi\* OR Dollyo\* OR Mawashi\* NOT Swimming\* NOT Football\* NOT Rugby\* NOT Futsal\*  Limit to: from 1982 to 19th May 2022, Article, English |

**Table S2.** Summary of studies

| **Authors** | **Participants** | **Kick Type** | **Measure equipment** | **Variables** |
| --- | --- | --- | --- | --- |
| Abraham et al., 2001 | 8 elite men | Front and roundhouse kick  Martial arts | Peak Motus system (Peak Performance Technologies, USA, 200 Hz) | Maximum velocity (foot) |
| Branco et al., 2019 | 9 elite men, 54.2 ± 3.9 y  173 ± 6.6 cm, 78.5 ± 7.5 kg  24 elite men, 23 ± 5.8 y, 174.2 ± 7.9 c, 73.1 ± 14.6 kg | Front kick  Karate | High-speed camera (Casio EX-FH20, sampling frequency of 210 Hz) | Maximum velocity (foot, knee, hip)  Maximum angular velocity  Initial, contact, max., and min. angle |
| Cynarski et al., 2018 | One elite man, 36 y, 97 kg, 177 cm | Front kick  Karate | Force plate (Kistler, type 9286AA, Kistler, Switzerland). | Execution time |
| Detjareny et al., 2012 | 5 sub-elite men, 21.4 ± 2.3 y,  169.2 ± 6.6 cm, 60.6 ± 10.4 kg | Roundhouse kick  Taekwondo | Eight 100-Hz cameras (Natural Point Inc., USA), DAQ NI USB–6008 (National Instruments, USA) | Maximum velocity (foot)  Maximum angular velocity  Response time |
| Diniz et al., 2018 | 17 elite men, 23.7 ± 1.2 y, 174 ± 2 cm, 73.8 ± 2.5 kg  15 elite men, 25.2 ± 0.8 y, 178 ± 1.43 cm, 71.3 ± 3.6 kg  15 elite men, 28 ± 1.3y, 175 ± 1.74 cm, 74.8 ± 2.6 kg | Roundhouse kick  Taekwondo, Karate, Muaythay | VICON Motion Capture System, 6 cameras, 200Hhz) | Angular Velocity |
| Dworak et al., 2003 | 21 sub-elite men, 26.4 ± 6.8 y, 179 ± 5.2 cm, 78.5 ± 6.5 kg | Front kick  Karate | Force plate (Kistler 9261A)  MRC (device for measuring velocity) | Impact Force  Maximum velocity (foot) |
| Estevan et al., 2011 | 13 elite and 14 sub-elite men, 26.6 ± 2.2 y, 177 ± 8.9 cm, 72 ± 12.7 kg | Roundhouse kick  Taekwondo | Force plate (A201 model by Tekscan Company Inc., South Boston, MA, USA) | Impact time  Execution time (during the hit)  Impact time (during the hit) |
| Estevan et al., 2012 | 15 sub-elite men, 25 ± 5.7 y, 73.4 ± 3.7 kg | Roundhouse kick  Taekwondo | Force plate (A201 model by Tekscan Company Inc., South Boston, MA, USA) | Impact Force |
| Estevan & Falco, 2013 | 12 elite men, 24.3 ± 3y, 179 ± 6 cm, 77.9 ± 10.3 kg  21 sub-elite men, 25.7 ± 7 y, 178 ± 9 cm, 75.7 ± 11.8 kg | Roundhouse kick  Taekwondo | The dummy (706 FSD ®, USI Universal Company, India) | Impact Force  Execution time |
| Estevan et al., 2014 | 33 sub-elite men, 24.4 ± 5.4y, 175 ± 0,1 cm, 72.5 ± 13.36 kg | Roundhouse kick  Taekwondo | Force plate (A201 model by Tekscan Company Inc., South Boston, MA, USA) | Impact Force  Execution time |
| Falco et al., 2009 | 15 elite men, 23.5 ± 3.3y, 174 ± 0.12 cm, 69.97 ± 13.76 kg  16 novice men, 23.5 ± 3.3 y, 172 ± 0,1 cm, 68.12 ± 13 kg | Roundhouse kick  Taekwondo | Five piezo-resistant pressure sensors (A201 model by FLEXIFORCE Company) | Impact Force  Execution time |
| Falco et al., 2013 | 13 elite men, 21.57 ± 4.75 y, 179 ± 0.1 cm, 76.8 ± 10 kg  21 sub-elite men, 21.57 ± 4.11y, 176 ± 0,1 cm, 75.5 ± 11.2 kg | Roundhouse kick  Taekwondo | Force plate (2000 Hz) | Impact Force  Execution time |
| Gavagan et al., 2017 | 8 elite men, 22.3 ± 4.1 y, 174.6 ± 0.1 cm, 65.6 ± 8.4 kg  8 elite men, 28.6 ± 9.5 y, 178 ± 0.05 cm, 95.8 ± 13.4 kg  8 elite men, 30.3 ± 10.7 y, 179 ± 0.14 cm, 4.5 ± 20.1 kg | Roundhouse kick  Muay Thai  Taekwondo  Karate | Qualisys Motion Capture System (Qualisys AB, Gothenburg, Sweden) 500 Hz  PowerLab system (PowerLab 8SP, ADInstuments, Inc. USA) 1000 Hz | Impact Force  Maximum velocity (foot)  Maximum angular velocity |
| Goethel et al., 2019 | 7 elite men, 26.3 ± 6.9 y, 170 ± 10 cm, 77.5 ± 12.8 kg  7 sub-elite men, 27.5 ± 6.1 y, 170 ± 10 cm, 75.1 ± 8.9 kg | Front kick  Karate | Vicon Nexus (7 cameras, sampling frequency 250 f/s) | Maximum velocity (foot)  Maximum angular velocity  Continuous relative phase |
| Górski & Orysiak, 2019 | 6 elite men, 20 ± 3.2 y, 185 ± 8.5 cm, 75.3 ± 10.9 kg | Roundhouse kick  Taekwondo | Two tri-axial accelerometers with triaxial gyroscope modules, 500 Hz | Impact Force |
| Chinnasee et al., 2017 | 6 elite men, 21.5 ± 1.09 y, 172.6 ± 4.94 cm, 87.45 ± 5.93 kg | Roundhouse kick  Taekwondo | Vicon T10s (Oxford Metrics, UK) 100 Hz | Maximum Velocity (foot) |
| Jeon et al. 2021 | 11 elite men, 21.27 ±1.19 y,  72.5 ± 9.96 kg  11 novice men, 22.91 ± 1.62 y, 170 ± 7.99 cm, 75.2 ±10.49 kg | Roundhouse kick  Taekwondo | Prime 13 (Optitrack, USA, eight motion capture cameras) | Total execution time |
| Jung & Park, 2018 | 10 elite men, 21.7 ± 0.5 y, 173.1 ± 4.3 cm, 60.6 ± 3.7 kg | Roundhouse kick  Taekwondo | MX-13 Vicon™ motion capture system (Vicon, Ltd., Oxford, UK) 250 Hz | Maximum velocity (foot) |
| Kim et al., 2011 | 12 elite men, 20.4 ± 8.4 y, 180 ± 0.04 cm, 71.9 ± 8.4 kg | Roundhouse kick  Taekwondo | Six-camera motion analysis system (Hawk® Digi- tal Real Time System, Motion Analysis System, Santa Rosa, CA, USA) 200 Hz | Maximum velocity (foot)  Execution time |
| Liu et al., 2021 | 19 elite men, 19.9 ±0.98 y, 177.57 ± 6.07 cm, 67.84 ± 9.65 kg | Roundhouse kick  Taekwondo | Eight-camera motion analysis system (Eagle, Motion Analysis Corp., Santa Rosa USA) 200 Hz | Maximum velocity (foot, knee, hip)  Maximum angular velocity |
| Moreira et al., 2018 | 5 elite men and 2 women, 23.6 ± 2.1 y, 168 ± 5 cm, 69 ± 9.5 kg  5 sub-elite men and 2 women, 22.4 ± 2.1 y, 174 ± 11 cm, 66.8 ± 14.2 kg | Roundhouse kick  Taekwondo  (Execution into the Air) | Force platform OR-6 (AMTI®)  NEXUS motion capture system (Vicon®, v.2.0) seven cameras 250 Hz | Maximum velocity (foot, knee, hip)  Maximum angular velocity  Execution time  Ground reaction forces |
| Moreira et al., 2021 | 5 elite men and 2 women, 23.6 ± 2.1 y, 168 ± 5 cm, 69 ± 9.5 kg  5 sub-elite men and 2 women, 22.4 ± 2.1 y, 174 ± 11 cm, 66.8 ± 14.2 kg | Roundhouse kick  Taekwondo  (Execution into the target) | Vicon1MX13 cameras, sampled at 250 Hz | Maximum velocity (foot, knee, hip)  Maximum angular velocity  Execution time |
| Nien et al., 2007 | 6 elite men | Roundhouse kick  Taekwondo | Eight high speed cameras (sampling rate 120 Hz) | Maximum Velocity (foot and knee)  Maximum angular velocity |
| Olsen et al., 2003 | 18 novice men, 27 ± 7.5 y, 181.5 ± 10.5 cm, 85 ± 11 kg | Front kick  Martial arts | Force plate (1000 Hz) | Impact Force |
| Petre & Teodoru, 2013 | 10 sub-elite men, 21 – 23 y | Roundhouse kick  Taekwondo | Panasonic cameras, Video captures with Quintic sports video analysis system | Maximum velocity (foot) |
| Portela et al., 2014 | 8 elite men, 30 ± 10.2 y, 178.9 ± 4.9 cm, 85.3 ± 12.2 kg | Front kick  Karate | Casio FH25, with a frequency of 240 Hz | Maximum velocity (foot) |
| Pozo et al., 2011 | 8 elite men, 24.2 ± 10.6 y, 174.4 ± 8.6 cm, 70.3 ± 9.3 kg  9 sub-elite men, 37.9 ± 9 y, 176.4 ± 7.9 cm, 76 ± 11.3 kg | Front kick  Karate | 2D high-speed camera (Basler piA640-210gc, Basler AG)  3D-Force Plate (Arsalis, Louvain-la-Neuve, Belgium) | Total and phase execution time  Impact force |
| Quinzi et al., 2013 | 6 elite men, 24.2 ± 10.6 y, 174.4 ± 8.6 cm, 70.3 ± 9.3 kg  6 sub-elite men, 37.9 ± 9 y, 176.4 ± 7.9 cm, 76 ± 11.3 kg | Roundhouse kick  Karate | Vicon System, Oxford Metrix, UK, 120 Hz | Maximal angular Velocity  Execution time |
| Quinzi et al., 2016 | 6 elite men, 15.5 ± 1 y, 170 ± 10 cm, 57.5 ± 4.8 kg | Roundhouse kick  Karate | Vicon System, Oxford Metrix, UK, 100 Hz | Maximal angular Velocity  Execution time |
| Sbriccoli et al., 2010 | 6 elite men, 24.8 ± 1 y, 73.8 ± 4 kg  6 novice 27.8 ± 1 y, 77 ± 3.6 kg | Front kick  Karate | MARG (MTx, Xsens Motion Technologies, 3D linear accelerometer, 3D angular rate sensor, 3D magnetometer) | Angular Velocity |
| Tang et al., 2007 | 6 elite men | Roundhouse kick  Taekwondo | 10 high speed cameras (Eagle cameras, Motion Analysis Corporation, Santa Rosa, CA, USA) 120 Hz | Maximum velocity (foot)  Angular velocity (hip, knee) |
| Thibordee & Prasartwuth, 2014 | 8 elite men, 24.3 ± 5.9 y, 172 ± 0.05 cm, 88.7 ± 4.2 kg  8 sub-elite men, 16.8 ± 7.7 y, 162 ± 10 cm, 49.3 ± 12.9 kg | Roundhouse kick  Taekwondo | Mono-axial force transducer (2 kN; LC 1205-K200, A&D Co Ltd., Japan, 200 Hz). | Impact force |
| Vagner et al., 2018a | 6 novice men, 22.2 ± 1.5 y, 180.6 ± 4.8 cm, 78.8 ± 5.8 kg | Front kick  Musado | Triaxial force plate Kistler 9281 (1000 Hz) | Maximum force  Impulse  Time to reach maximum force |
| Vagner et al., 2018b | 5 sub-elite men, 23.3 ± 1.7 y, 175.5 ± 4.5 cm, 74.3 ± 6.2 kg | Front kick  Musado | Triaxial force plate Kistler 9281 (1000 Hz) | Maximum force  Impact force  Time to reach maximum force |
| Vagner et al., 2020 | 25 sub-elite men, 27.7 ±7.2 y, 180.5 ± 6.5 cm, 83.8 ± 6.1 kg | Front kick  Musado | Triaxial force plate Kistler 9281 (2000 Hz)  Qualisys 2.2, Sweden (500 Hz). | Maximum force  Impact Force  Impulse  Maximum Velocity |
| Vagner et al., 2021 | 8 sub-elite men, 21.3 ± 0.9 y, 179.6 ± 5.2 cm, 76.8 ± 6.4 kg  8 sub-elite men, 22 ± 1 y, 184 ± 6.5 cm, 82.1 ± 5.4 kg | Front kick  Musado | Triaxial force plate Kistler 9281 (1000 Hz)  Qualisys 2.2, Sweden (1000 Hz). | Maximum and Impact Force  Impulse  Maximum Velocity  Angular Velocity  Execution time |
| Vagner et al., 2022a | 12 elite men, 31.8 ± 7.4 y, 179.8 ± 5.4 cm, 81.7 ± 6.1 kg  12 sub-elite men, 22.5 ± 2 y, 182.4 ± 6.3 cm, 81.7 ± 6.1 kg | Front kick  Musado | Triaxial force plate Kistler 9281 (1000 Hz)  Qualisys 2.2, Sweden (200 Hz). | Maximum and Impact Force  Impulse  Maximum Velocity  Angular Velocity  Execution time |
| Vencesbrito et al., 2014 | 14 elite men, 24 ± 7 y, 171 ± 7 cm, 72 ± 19 kg  16 novice men, 23 ± 6 y, 179 ± 6 cm, 73 ± 10 kg | Front kick  Karate | High speed camera  Casio EX‐FH20 (sampling frequency of 210 Hz) | Maximum Velocity  Contact time, onset time  Max. and min. angle |
| Wasik et al. 2015 | 6 sub-elite men, 16.5 ± 1 y, 176.5 ± 7.5 cm, 64.14 ±10.9 kg | Front kick  Taekwondo | Italian system (Smart-D, made by BTS S.p.A.; six cameras, 120 Hz) | Total execution time  Maximum velocity of the foot and knee |
| Wasik & Góra. 2016 | One elite man, 28 y, 172 cm, 68 kg | Front kick  Taekwondo | 10 NIR Vicon MX-T40 cameras, speed of 370 frames per/s, 4 megapixels (2352 x 1728 px) in 10-bit greyscale | Maximum velocity of the foot  Execution kick into:  Air, Table tennis ball, Shield |
| Wasik et al. 2018 | 8 sub-elite men, 18.3 ± 1.7 y, 176.2 ± 3 cm, 70.4 ± 6 kg | Front kick  Taekwondo | VICON Motion Systems MX40, Oxford Metrics Ltd., Oxford, England, 250 frames/s) | Maximum velocity (foot)  Execution time into:  Air, Board, Small-ball, Shield |
| Wasik et al. 2021 | 15 elite men, 22.5 ± 6.2 y, 175.7 ± 8.4 cm, 71.9 ± 11.5 kg | Roundhouse kick  Taekwondo | 10 NIR Vicon MX-T40, resolution of 4 MP (2352 x 1728 pixels) 370 Hz | Maximum velocity (foot, knee, hip) |



### **Figure S1.** Assessment of methodological quality and risk of bias

Note: low risk of bias “+”, some concerns “–“, high risk of bias “x“, and no information “?”; D1 – Was an informative and balanced summary of what was done and what was found provided in the abstract? D2 – Was the scientific background of the study explained? D3 – Were the eligibility criteria and the sources and methods of selecting participants stated? D4 – Was the condition measured in a standard, reliable way for all participants included in the study? D5 – Was the execution of the measurement of the dynamic or kinematic indicators described in sufficient detail to permit its replication? D6 – Were any efforts to address potential sources of bias described? D7 – Were outcomes and conclusions clearly defined?